

Enterprise Risk Management Framework as an Ecosystem

Laura Whitaker¹

0.1 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. In order 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 behalf of all of its shareholders
- instill a common risk culture and language that is well understood and practiced by all levels/ business units and
- 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 “1-in-200” events. In reality, those external risks can destroy a weak or adequately rated ERM ecosystem. How will your ERM ecosystem survive the perils and continue to flourish through evolving climate changes?

0.2 INTRODUCTION

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 then 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. This paper concludes with final remarks highlighting the key takeaways for ERM practitioners to create a healthy ERM ecosystem in Section 5.

“**Ecology** is an academic discipline devoted to the study of **environmental systems**” (Hall, 2014)². 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 environment². 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 ecosystem².

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² Hall, C. (2014, October 26). Ecology (J. Weis, Ed.). The Encyclopedia of Earth. Retrieved January 3, 2016, from <http://www.eoearth.org/view/article/151932/>

1 ECOSYSTEM

1.1 WHAT IS AN ECOSYSTEM?

An **ecosystem** is a complex set of living things (plants, animals, and organisms) interacting with each other, and with their non-living environment (weather, earth, sun, soil, climate, and atmosphere)³. 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 non-living elements. An ecosystem is a biological community comprised of the living members known as *biotic* factors and the non-living features create the *abiotic* factors⁴.

Consider a small pond in your backyard as a simple example of an ecosystem. In this pond, 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 pond, the living plants and organisms would cease to exist³. For instance, if the green plants and algae are removed from the pond, 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 therefore 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 is supportive evidence that when a particular area of an ecosystem fails, it will have an unfavorable effect on the rest of the ecological community³.

1.2 HOW DOES AN ECOSYSTEM WORK?

1.2.1 Definition of an Ecosystem

An ecosystem is a play 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 minerals⁴ that we consume. Our very own vitality as human beings is dependent upon the offspring of ecosystems. Preservation of the coral reefs, rain forests, and bodies of water is our global responsibility.

1.2.2 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.

Let's revisit an earlier part of food chain, where photosynthesis occurs. Before the producers are ready to convert the energy, radiated by the sun, into food, carbon dioxide (CO₂) has to be first absorbed³. Without CO₂, 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 recycled⁴. Some energy is lost and emitted as heat into the air, but a portion is transferred into the very building blocks of life⁵.

1.2.3 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

³ What Is An Ecosystem? (2015). Retrieved January 3, 2016, from <http://eschooltoday.com/ecosystems/what-is-an-ecosystem.html>

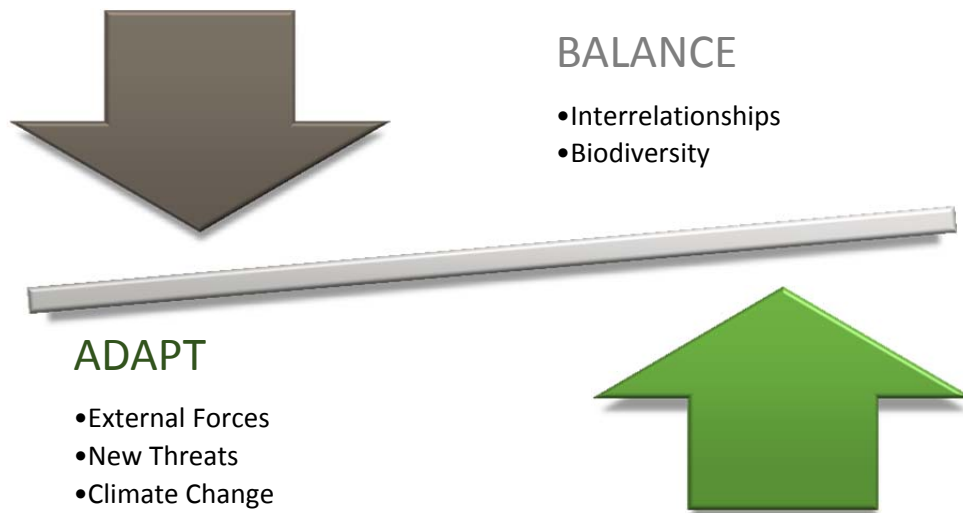
⁴ Overview of Ecosystems. (2014). Retrieved January 4, 2016, from <http://enviropol.com/index.php/overview-of-ecosystems>

potentially harm or ultimately destroy the ecosystem⁴. Activities, such as mining, farming, construction, overfishing, pollution, and UV radiation, have catastrophic consequences on ecosystems, endangering the living species⁴. Climate change remains a constant hazard toward the health of ecosystems. Climate change appears as an important theme throughout this dissertation.

1.2.4 Biodiversity

Ecosystems have proven to be resilient by adapting to change. “A sustainable ecosystem necessitates balance in all interrelationships, proper adaptability/treatment of new threats, as well as the support of biodiversity” (Overview of Ecosystems, 2014)⁴. **Biodiversity** is the variety of life in the world or in a particular habitat or ecosystem⁵. 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 1: The Dynamic Interaction between Balance and Adapt



1.2.5 Adapting and Balancing

The figure above 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, or
- inducing slight shifts to the naturally occurring cycles to adjust accordingly.

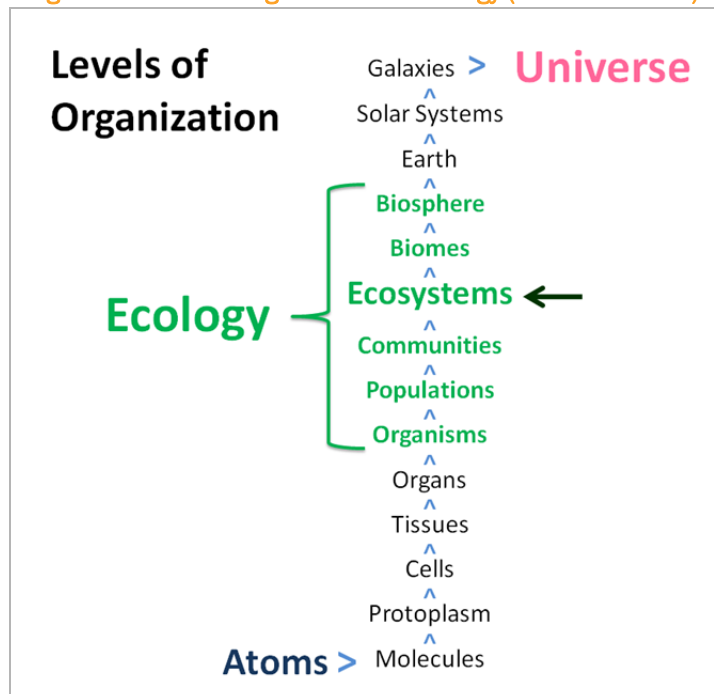
The balancing side is seeking out harmony among its cohabitants to better face disruption or climate change. A system supporting both sides, equally and attentively, will be best equipped to thrive under severe circumstances. Reliance on **keystone species** becomes prevalent in such scenarios. Keystone species are detailed in subsection 1.4 below.

1.3 LEVELS OF ORGANIZATION OF ECOLOGY

We are all a part of a much larger spectrum; one that is 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.

⁵ Oxford Dictionary. Biodiversity. Oxford University Press ©. Retrieved January 4, 2016, from http://www.oxforddictionaries.com/us/definition/american_english/biodiversity

Figure 2: Levels of Organization of Ecology (Credit: Erle Ellis)⁶

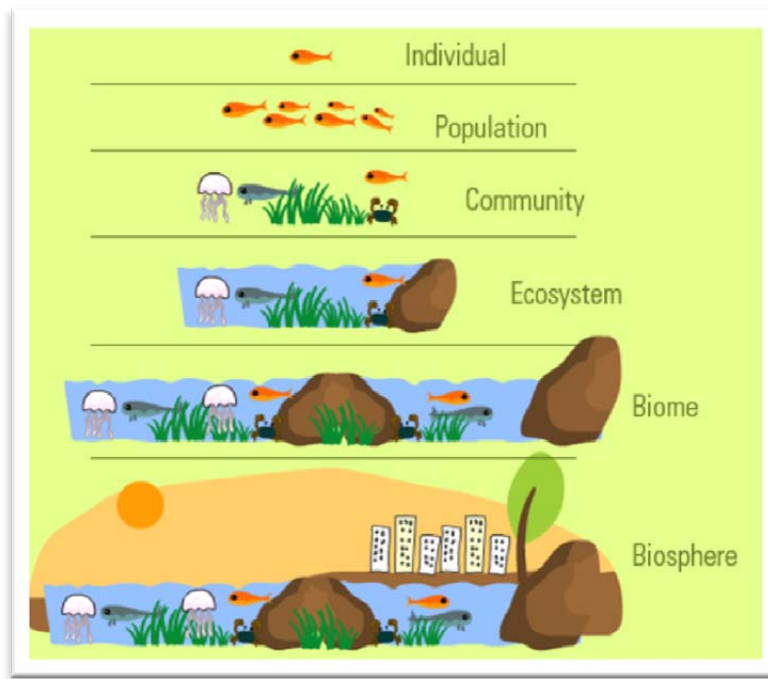


In the figure above, there are six levels of organization which compartmentalize ecology. Let's take a closer look at each of the following levels:

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. In the diagram below, the fish swimming 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. As shown in the figure beneath, there are different species cohabitating in a single location at a particular point in time – gold fish, 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 non-living 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.

The organization levels can be used to break down our ERM Frameworks which is described in Section 3.

⁶ Ellis, E. (2014, September 24). Ecosystem. In J. Duffy (Ed.), The Encyclopedia of Earth. Retrieved January 3, 2016, from <http://www.eoearth.org/view/article/151932/>

Figure 3: Levels of Organization Diagram (Credit: <http://eSchoolToday.com>)³

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.

1.4 KEYSTONE SPECIES

In 1969, Zoologist Robert T. Paine first postulated the existence of "**keystone species**"⁷. Paine and his students from the University of Washington removed the starfish species from an area on the coast of Tatoosh Island, Washington, over a span of 25 years, to observe the after effects⁷. Paine was one of the first scientists in his field to experiment in such an unconventional fashion. With the starfish gone, mussels overpopulated the area and forced out the other species. The starfish in the Tatoosh Island ecosystem was indeed a keystone species⁷. 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.

"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" (Keystone Species, 2011 National Geographic)⁷. This prevalent species regulates the other living and non-living members in a given ecosystem.

Another example is the sea otter the Pacific Northwest⁷. This keystone species feed on sea urchins, limiting the urchins' overpopulation⁷. Without the otter species, the sea urchins would consume all of the ecosystem's supply of kelp, or giant seaweed⁷. One may think nothing of it, but kelp is an essential food source and habitat for the ecosystem. Certain species of crustaceans and snails eat kelp⁷. Fish hide in the lush kelp forests as an escape from predators. The entire ecosystem is now "going concern". Classifying keystone species is an application which can be applied in ERM. At this point, we brushed up on Ecology 101 and will review the pillars of a sound ERM framework in the upcoming section.

⁷ Keystone species. (2011, January 21). National Geographic. Retrieved January 5, 2016, from <http://education.nationalgeographic.org/encyclopedia/keystone-species/>

2 ERM FRAMEWORK

2.1 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?

2.1.1 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” (Casualty Actuarial Society, 2003)⁸. A federation of key words has been strategically placed in this definition. Let's break it down into smaller units – *Discipline. Enterprise. Any industry. Assesses. Controls. Monitors. Risks. All sources. Short and long term value. Stakeholders.* 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.

In the *2013 Insurance Enterprise Risk Management Practices* by the American Academy of Actuaries (AAA)⁹, 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 that 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.

2.1.2 Risk Culture and Risk Language

Which risk language do you speak within your company? Is everyone fluent in the same language or 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 company-wide survey with the posed questions above may have surprising results. The responses may not be pleasant to one's ear, but nonetheless, it serves as an honest check.

The risk culture at any company should be easily understood and integrated throughout the enterprise. So as a test, any individual selected at random would 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*¹⁰. The list was not originally intended to be exhaustive, yet illustrative of the indicators used in any framework.

⁸ Casualty Actuarial Society (2003). Overview of Enterprise Risk Management.

⁹ American Academy of Actuaries. (2014, April 7). Insurance Enterprise Risk Management Practices. Development by the ERM Committee of the American Academy of Actuaries.

1. **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.*
2. **Accountability:** *Relevant employees at all levels understand the core values of the institution and its approach to risk, are capable of 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.*
3. **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.*
4. **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 institution¹⁰.*

2.1.3 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, and 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 storm. All tolerances and limits need to be approved, communicated, and executed, and reviewed. If there is a limit at breach, the risk should be escalated appropriately and in a timely manner. Hence why tolerances and limits need to be transparent and individuals held accountable. For a quick vocabulary review, the American Academy of Actuaries (AAA)⁹ has defined each of the terms accordingly:

- **Risk Appetite:** *The amount of specific risk and aggregate risk that 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 that the level of aggregate risk remains within the risk tolerance.*
- **Risk Profile:** *The risks to which an organization is exposed over a specified period of time⁹.*

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

¹⁰ Financial Stability Board. (2014, April 7). Guidance on Supervisory Interaction with Financial Institutions on Risk Culture: A Framework for Assessing Risk Culture.

2.1.5 Risk Identification

Revisiting the ERM definition again, **all** risks originating from **all** sources need to be identified, **known** or **unknown**. Perform bottoms-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 as 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 and ensure the decision and new method are well-documented.

2.1.6 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 (please refer to the Society of Actuaries' Actuarial Standards of Practice #23: Data Quality for additional details) 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 in 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 either by heat maps, influence matrices, tail risk extrapolations, etc. are critical for the hard to quantify risks.

2.1.7 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 out which risk aggregation technique is the most appropriate. The Basel Committee on Banking Supervision¹¹ compared and contrasted three aggregation methods:

- 1. 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 time¹¹. Correlations also assume a normal distribution of risks¹¹. These two shortcomings are contradicted in reality.
- 2. 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 distributions¹¹. An advantage to using copulas is specifying the dependencies among the risks¹¹. Copulas modelling tail dependence are used for risks known to be correlated in the tail¹¹. Explaining the assumptions and practice of building copulas can be complicated¹¹.
- 3. 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 formulas¹¹. Scenario-based aggregation is the most sophisticated approach. It can be applied consistently, yet requires additional resources and even funding for a cunning edge economic scenario generator.

2.1.8 Risk Monitoring: Risk-Adjusted Performance Metrics and Economic Capital

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,

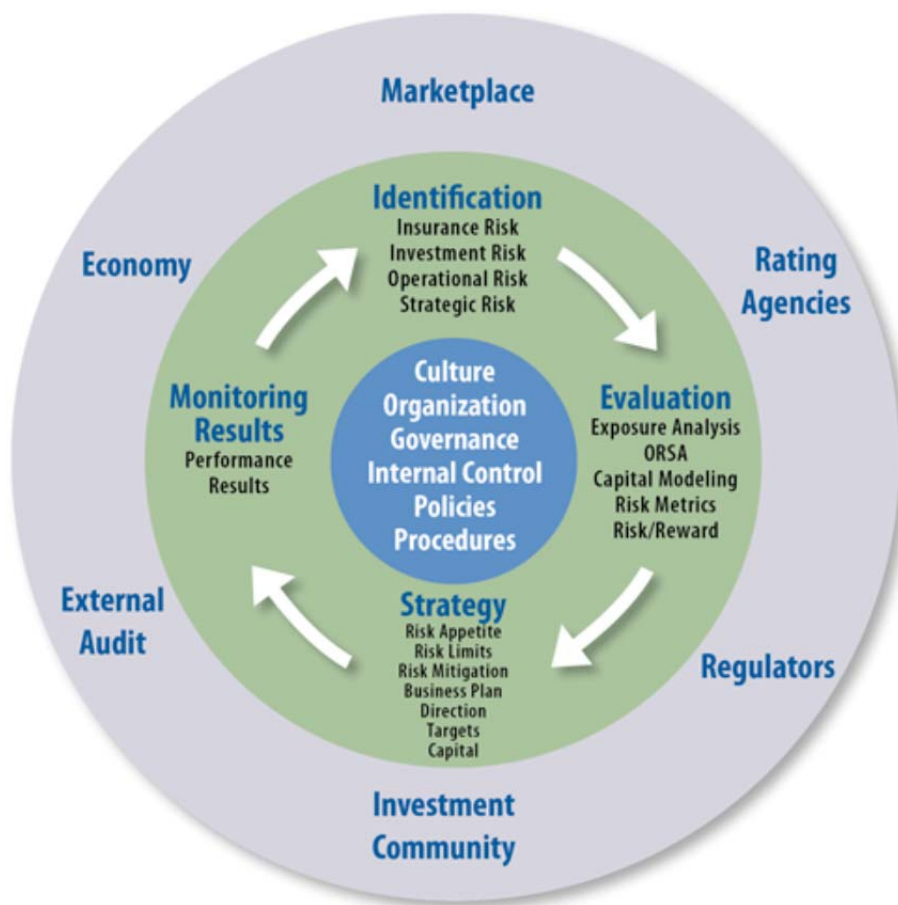
¹¹ Basel Committee on Banking Supervision (2010, October). Developments in Modelling Risk Aggregation.

performance risk metrics are a good gauge of where the company stands comparative to its target, e.g., 15% RAROC on new business, 450% Risk-Based 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” (American Academy of Actuaries, 2014)⁹. Economic Capital answers the shareholder’s question of how effectively is the available capital be used? Too much, 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 (S&P) ERM Assessment¹² 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 criteria¹². 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.

The following figure is a pictorial summary of an ERM Framework produced by the AAA:

Figure 4: Key Concepts in Employing an ERM Framework (Credit: American Academy of Actuaries)⁹



The framework’s shareholders appear on the most outer rim in gray. The Risk control cycle is in green and the risk culture, governance, and policy constitution are contained in the inner-most circle in blue – the nucleus of the framework.

This wraps up our quick overview of a sound ERM Framework. In the following section, the characteristics of an ecosystem are blended into an ERM framework.

¹² Manyem, S. (2015, May). S&P’s ERM Framework. Retrieved January 3, 2016, from <http://www.ultirisk.com/pdf/ultimate-risk-may-2015-sridahr-presentation.pdf>

3 ANALYSIS OF AN ERM ECOSYSTEM

Q: What is an “ERM Ecosystem”?

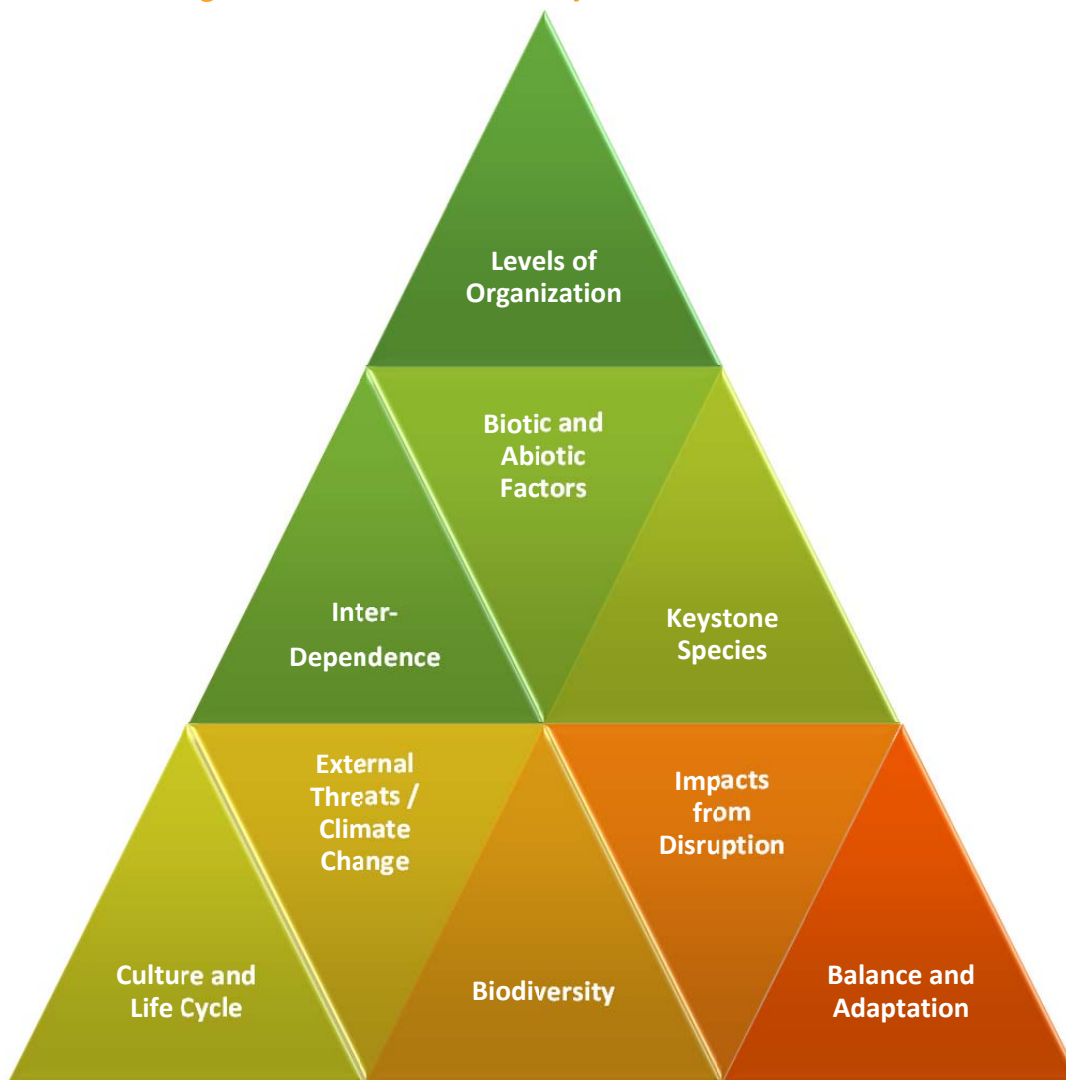
A: An ERM Framework which balances the complex interdependencies of its risks and processes while constantly adapting to an external, ever-changing environment to best achieve the goals set out by all of its constituents.

3.1 WHAT SIMILARITIES EXIST BETWEEN ECOSYSTEMS & 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 below. Believe it or not, a task you may perform 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 the triangular figure below. This is not an exhaustive list, but rather a cross-section of parallels:

Figure 5: Similarities between Ecosystems and ERM Frameworks

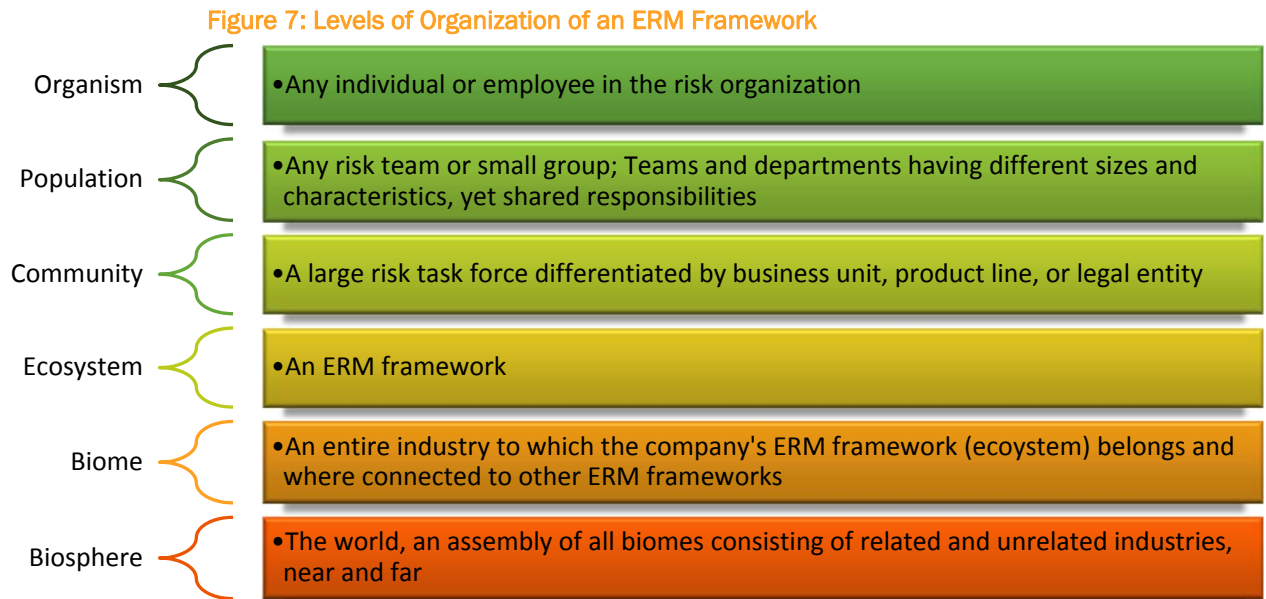


Each corollary is viewed from an ERM framework’s perspective in the following table.

Figure 6: Ecosystem Characteristics Defined in an ERM Framework

Similarities	ERM Framework Description
Levels of Organization	<ul style="list-style-type: none"> 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 the figure beneath the table.
Interdependence	<ul style="list-style-type: none"> Interrelationships exist among teams, units, risks, metrics, and the list goes continues the more granular one researches an ERM system. Acknowledging that risks simply do not live in isolation, there lies dependency on other risks, is a continual practice. The life cycle (highlighted below) reiterates the dependency of relationships among core risks, processes, and stakeholders.
Biotic and Abiotic Factors	<ul style="list-style-type: none"> The biotic factors are the risk employees. The abiotic factors embody the policies, risk appetite, tolerance and limits, the risk culture, risks, and the models measuring those risks.
Keystone Species	<ul style="list-style-type: none"> From the individual risk contributor to the CRO and to the Board, all influential risk professionals are classified as keystone species. 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.
Culture and Life Cycle	<ul style="list-style-type: none"> 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. The ERM Framework receives the energy from the life cycle. The principles outlined later in this section are the CO₂ components found in the ecosystem energy cycle.
External Threats / Climate Change	<ul style="list-style-type: none"> External threats are a type of emerging risk. Accounting for emerging risk in an ERM framework is crucial. Climate change can be taken by its phonetic meaning. The baby boomers are retiring and living longer. The millennials are undeniably the most proficient multi-taskers 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? 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. Even if the change is totally unrelated to your business, the risk could spill over in your own industry and is now a threat.
Biodiversity	<ul style="list-style-type: none"> 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. 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.
Impacts from Disruption	<ul style="list-style-type: none"> 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 labelled 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.
Balance and Adaptation	<ul style="list-style-type: none"> 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. The Board and Senior management also balances the expectations of the shareholders with its sales goals. Therefore, executive compensation should promote prudent risk taking behavior. The nimbleness of an institution during plausibly extreme or adverse extreme events is an important factor in recovery time following a disaster. Anticipating new trends could jumpstart the competition by developing the latest suite of products.

The six levels of organization defining our world in terms of ERM are as follows:



3.2 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, but definitely not far-fetched. Surely, the changes in ecosystems may be more gradual than say the movement of a stock price. But, 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.

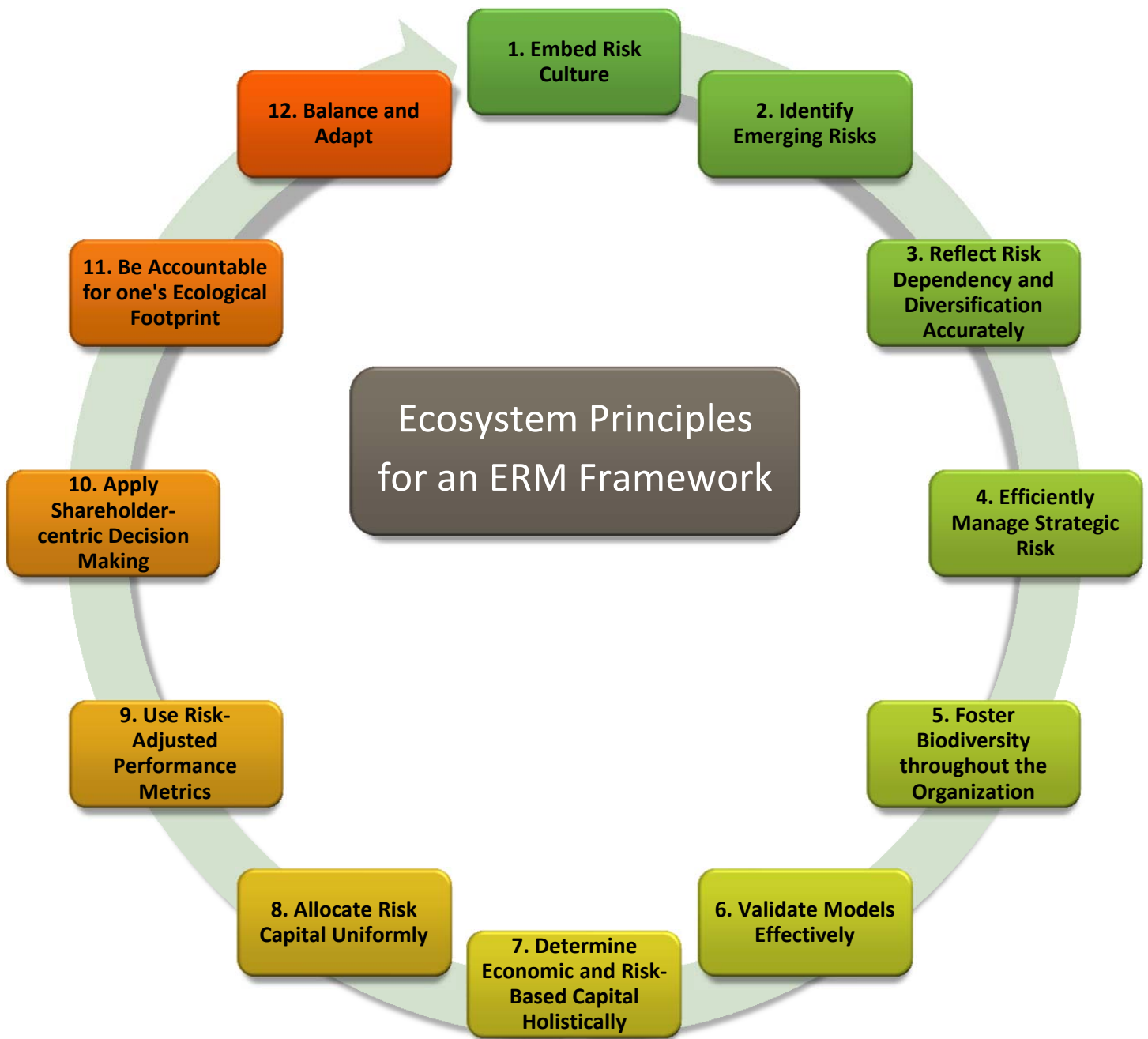
3.3 HOW CAN WE APPLY ECOSYSTEM BASICS TO OUR COMPLEX ERM FRAMEWORKS?

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. In order for an ERM framework to withstand events causing severe disruption to the system, an institution must:

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- instill a common risk culture and language that is well understood and practiced by all levels/business units and
- 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 “1-in-200” events. In reality, those external risks can destroy a weak or adequately rated ERM ecosystem. The following two diagrams feature the basic ecosystem principles applied in a sound ERM framework.

Figure 8: Ecosystem Principles in an ERM Framework



These twelve principles are the CO₂ found in the life cycle of an ecosystem. A vigorous ERM ecosystem unconditionally carries out each and every one of the principles. Recall from earlier, an **ERM ecosystem** is one which 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. The following page contains a deeper look into the twelve core ERM ecosystem competencies. Albeit the complex environment in which we work, these simple-natured principles can be followed every day in any industry to fend off external threats and adapt to new topographies.

Figure 9: Ecosystem Principles Applied in an ERM Framework

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, e.g., 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 the next section, two case studies are presented to understand how both ERM frameworks broke down. We pinpoint the specific ERM ecosystem principles that did not uphold in the two scenarios.

4 REAL WORLD SCENARIOS

4.1 CASE STUDIES

4.1.1 General Motors (GM)

General Motors (GM) in 2012 boasted a new ERM program estimated to add the type of value coveted by any risk professional, trade journalist, or academia¹³. Two short years later, in March 2014, GM recalled over 3.1 million cars experiencing ignition switch failures¹³. It was deemed a low probability event which prematurely peaked its head. Unfortunately, this low probability event's consequence included twelve fatalities, a \$300 million fine, and criminal litigation, not to mention the residual of reputational destruction. GM's risk management was overconfident in the effectiveness of its program¹³. *"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"* (Slezak, 2014)¹³.

The ERM ecosystem principles missing in this framework are as follows:

- 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.

4.1.2 American Online (AOL) and Time Warner

Reaching the summit of the Internet era, American Online (AOL) and Time Warner merged together in 2001¹⁴. The merger is deemed as one of the worst mergers recorded in history¹⁵. 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). Merging together, 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 billion¹⁴. Love at first sight, right? Wrong. The synergies were overestimated, the two company cultures clashed, the dot.com bubble blew up, and dial-up internet quickly became a thing of the past. Two years later, AOL/Time Warner had no other choice but to write down \$46 billion to report an annual loss amounting to a \$100 billion¹⁴. In 2009, the two companies "filed for divorce"¹⁴.

The two populations were separated by their cultural environments and could not cohabitate under one company. A fairytale ending may have transpired if AOL/Time Warner embraced biodiversity, instead of shying away the culture

¹³ Slezak, S. (2014, March 26). GM's risk management failure a lesson for other firms | GRI. Retrieved January 6, 2016, from <http://globalriskinsights.com/2014/03/gms-risk-management-failures-provide-example-for-other-firms/>

¹⁴ Ruesnik, M. (2015, September 28). Top Corporate Mergers: The Good, The Bad & The Ugly. Retrieved January 7, 2016, from <http://www.rasmussen.edu/degrees/business/blog/best-and-worst-corporate-mergers/>

¹⁵ McGrath, R. (2015, January 10). 15 years later, lessons from the failed AOL-Time Warner merger. Retrieved January 7, 2016, from <http://fortune.com/2015/01/10/15-years-later-lessons-from-the-failed-aol-time-warner-merger/>

clash. AOL/Time Warner's focus was not necessarily placed on how the merger was to be executed; it merely sounded like a win-win situation, despite the hefty price. Assessing how shifts in technology alter future profitability did not stack high on the priority list either.

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

- Embed Risk Culture
- Efficiently Manage Strategic Risk
- Foster Biodiversity throughout the Organization
- Apply Shareholder-centric Decision Making
- Balance and Adapt

5 CONCLUSION

5.1 FINAL REMARKS

An ecosystem is a complex set of living things (biotic factors) interacting with each other and with their non-living 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 dubbed a new term, the **ERM ecosystem** – a framework which 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:

Ecosystem Principles in an ERM Framework

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 self-centered, careless decision making. However, frameworks can adapt and balance to assimilate to survive such unprecedented events – it requires execution of what nature has taught us. I'll challenge you again as I did in the beginning. How will your ERM ecosystem survive the perils and continue to flourish through evolving climate changes?

6 REFERENCES

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