Thinking Ahead Institute

Willis Towers Watson

System thinking and investment

Introducing the ecosystem perspective

Introducing an investment ecosystem

Viewing the economy, the firms of which it is comprised and its financial systems as ecosystems has gained popularity in recent years. Over time economies and financial markets have become more interconnected such that this change in perspective, from considering how a single individual firm might compete to thinking about the system as a whole, is a natural progression. We believe this approach allows better assessment and management of risks faced by individual firms as well as systemic risks. In particular those risks that might be described as the tragedy of the commons (where the self-interested actions of individuals leads to the demise of the group) come into focus and we can begin to consider how pressures both within the investment system and applied from outside will shape how it changes over time.

In practice when an industry is viewed as an "ecosystem" this is often short-hand for saying there are many interconnected firms in that industry, which on some levels compete and on other levels rely on each other. The "fintech ecosystem" is a currently popular example. This ecosystem is often defined as comprising fintech start-up companies. In the case of fintech, the ecosystem should include the full scope of interactors with those fintech firms. This includes the firms themselves, their suppliers, established finance firms with whom they compete, providers of the infrastructure and technology they use, their customers and importantly the relationships between those entities. So, while the ecosystem description is apt we believe what is considered an ecosystem is often only a subset of the influences that affect the system being investigated. To capture the benefits of applying systems thinking, the ecosystem being considered should be as broad as possible.

The Thinking Ahead Institute's 2015 report State of the industry (SOTI) describes the investment industry in terms of an ecosystem by considering it as a whole rather than focusing on particular subsets of the ecosystem. SOTI describes an industry with many entities both competing and cooperating with each other to deliver a service to the owners of capital (savers) and the users of capital (companies and governments) subject to different influences and trends. These influences (direct and indirect) and trends are considered in aggregate to assess how the industry might evolve.

The alternative to this approach is to consider each of those entities or influences/trends independently. Applying this approach to technology trends within investment might lead to the conclusion that adopting better technology confers a competitive advantage. This could be termed an episodic or anecdotal approach and represents an incomplete analysis as it overlooks how a competitor's actions may also change in response to opportunities in technological advancement.

By applying concepts of systems thinking we can form a better understanding of the investment system than by considering its components in isolation. To some extent that sounds obvious, so what is a clear advantage of systems thinking? First, we would observe that issues such as the rise of passive investing or the in-sourcing of asset management functions by large asset owners can be understood in the context of an evolving system responding to the preferences and actions of its component entities. If we wish to gain an understanding of these trends and how they may play out in the future we must bring systems thinking to bear on these issues.

A more prosaic example of the benefit of systems thinking is one of risk management when considering a portfolio of strategies. Typical risk management tools are focused on telling us what we own (for example, in terms of asset types, geography and currency) and how "risky" those are (volatility, correlations, drawdowns etc) assuming tomorrow is much like yesterday. This is fine in general, but does not tell us about the portfolio's dynamics – how it will change over time. Most modern risk models are blind to how the portfolio's assets will evolve in the future and it is this evolution in response to changing conditions that means tomorrow does not look like yesterday. For example, the emergent effect of crowding can result in unexpected losses or the disappearance of portfolio diversification as related strategies coalesce on a single bet about the future of markets. It is our view that these types of risks matter to asset owners and their agents, the asset managers and consultants. The application of systems thinking is needed to try to manage risks such as this that arise from within the system itself - although this is far from easy.

But before we can begin thinking about the investment ecosystem let us first consider what an ecosystem is and some features that we should be aware of.

What is an ecosystem?

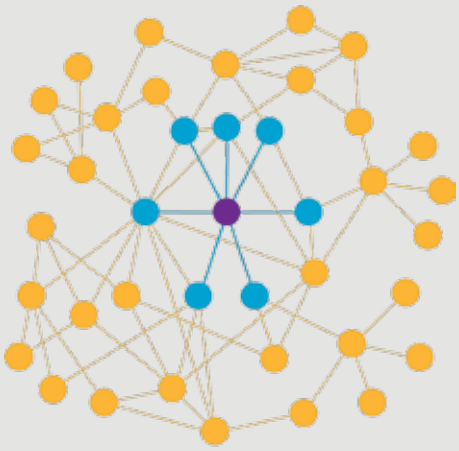
The most familiar concept of an ecosystem is a description of the plants and animals within a particular habitat. However, the ecosystem concept is much broader than this definition. In essence, an ecosystem is a collection of entities that interact with each other and their environment, and the environment itself. The concept of evolution is central to this understanding, since behaviours and relationships are constantly adapting in response to the other elements of the environment.

The idea that entities within an ecosystem are connected through their interactions and are a product of and influence on their environment is in radical contrast to the alternative view that those same entities' actions do not affect one-another and that they function independently from their environment. When viewing plants and animals living together in a particular habitat the ecosystem way of thinking is very natural: we intuitively understand that removing an apex predator or introducing new animals will affect the other species in that ecosystem. Despite this, history has shown that we do not always apply this understanding, nor do we appreciate the impact that seemingly small changes can have on an ecosystem as a whole. In other fields, such as investment, it is far from conventional for practitioners to apply this type of thinking even if we intuitively agree with the underlying ideas. As mentioned, investors are inclined to assess the likely impact of their actions in isolation and therefore potentially miss the additional impact from other investors acting in a similar manner.

Applying ecosystem ideas to business

An early application of the ecosystem concept to business was by James Moore. In 1993 the Harvard Business Review published an article titled "Predators and Prey: A New Ecology of Competition" which sought to describe companies and how they compete and cooperate through the lens of corporate ecosystems competing over markets for products or services. He describes the corporate ecosystem as extending from a particular company to include its customers, suppliers and rivals competing to meet a similar consumer (retail or business) need.

Figure 1. **A Porter's five forces analysis within a wider corporate ecosystem**



Company of interest

Stylised Porter's five forces influences

Company's wider corporate ecosystem

source Willis Towers Watson

This ecosystem perspective of how businesses operate is somewhat at odds with the more classical "Company A vs Company B" lens of corporate competition. For well-established and highly-vertically-integrated industries maybe the "Company A vs Company B" perspective is sufficient but where there is continued change, low vertical integration and many ways of meeting consumer needs the ecosystem perspective seems a more useful analytical lens. If taking an "ecosystem perspective" seems a big step then consider that, although not explicit, applying Porter's five forces (an established approach to analysing a company's competitive position) to analyse a company is an exercise in gaining understanding of that company's local exposure to its ecosystem. However, as figure 1 shows this analysis is likely to only reveal a small part of the ecosystem that influences the future of that company.

What are the building blocks of an ecosystem?

In a biological ecosystem we are familiar with we can easily visualise the more obvious components of the system. These are the species of plants and animals that live in the ecosystem and their relationships, typically imagined from the perspective of food consumption. Generalising, we can consider an ecosystem as being comprised of the following building blocks:

1. **Entities** – These are the components of the ecosystem. Entities in the investment ecosystem include asset owners, asset managers, consultants, brokers, investment banks, etc.
2. **Resources** – The entities in the ecosystem collect and spend the resources of the system. This activity changes the distribution of those resources between entities. The amount of resources an entity has will affect its relationships with other entities and its ability to effectively execute different processes.
   - **Stock** – This is a measure of how much resource an entity has acquired. In a biological ecosystem biomass is a classic example of a stock quantity. In investment the equivalent might be assets under management.
   - **Flow** – A measure of the change in resource an entity has access to. Net flow might be small (stock remains steady) but gross flow (input + output) might be large. In biological system it is often gross flow that is most useful in understanding an ecosystem. Within the investment ecosystem a portfolio's return would be an example of a net flow (in that it represents a change in stock) while its turnover is a measure of a gross flow (of securities).
3. **Processes** – While not literally a "building block", processes are employed by entities to enable them to compete for resource within the ecosystem. Collectively its processes constitute an entity's behaviour and this influences the relationships between entities. For example, the process by which a predator hunts determines its relationships to other animals. An entity can change its processes over time. An example of this in the corporate ecosystem would be how firms change their business model due to competitive pressures. The extinction of entities from an ecosystem is a manifestation of an inability to evolve their processes to remain competitive. Those entities that can continue to remain competitive can survive a long time, although there is path dependence to how processes can change. In the corporate ecosystem acquiring other firms or selling divisions is one way that a firm can change its processes and survive. Processes in the investment ecosystem include strategies for allocating capital and the business models of asset owners, managers and consultants.

These building blocks are a very general abstraction of what makes up an ecosystem. When we consider biological ecosystems we are familiar with the entities, resources and processes so that we don't have to give them much thought. In the investment system (or other artificial systems) it can be less clear what these are but by applying this framework we can be consistent in our approach and understand where there are similarities and differences between different types of ecosystems.

Time, dependence and feedback loops

Having defined the building blocks of the ecosystem we have a set of entities, each utilising many processes (some widely used, some used by only a few) to gain access to the resources they need. The processes of these entities create a network of relationships between them. A food web is the classic example in a biological ecosystem.

The relationships between entities means that the actions of one entity are transmitted through the network and can affect entities that were unaware of the original action. For example, if an investment consultant changes its rating on a particular manager (let's say from a "buy" to a "sell" rating) there will be a direct effect with capital being re-allocated from that manager to other asset managers. In addition, asset owners may take that opportunity to re-visit their asset allocation more broadly resulting in inflows to a product of a different manager in a different asset class to where the downgrade occurred. This one event has therefore triggered a reorganisation of the quantities and processes that has the potential to affect the entire ecosystem.

It is when thinking about how things change over time that the concept of an ecosystem (and systems thinking) comes into its own. When time frames are short and response to change is linear then we can get away with ignoring systemic effects. But when effects are non-linear and the time frame of interest becomes longer then considering the system is important. An example of this in financial markets would be an investment strategy (a process) that works successfully if one small part of the market is doing it (portfolio insurance(PI)[1] for example) but if too many investors (which could still be a small number relative the market) attempt to follow the same strategy then at best the strategy does not offer outperformance and at worse creates systemic losses. If such a strategy is assessed in isolation it appears compelling but if considered in the context of the system, then the issues with the strategy become apparent.

[1]The application of PI (either by selling equity directly or hedging an equity portfolio with futures) by a critical number of investors is often cited as triggering the 19 October 1987 stock market crash.

How the entities in a network are connected affects the behaviour of that network. In a network, feedback occurs when the output of at least one component (A) of the network is an input to another component (B) that is also an input of A – albeit there may be a number of intermediate links between A and B. The PI example shows how a positive feedback loop (amplification of an effect) can occur in the investment system. In this case the feedback loop is created by the decision to buy/sell equity being based on price, and the act of buying/selling equity further moving the price. The so-called "quant crunch" in 2007 is another example of positive feedback within the system amplifying price movements.

The opposite case is negative feedback. Negative feedback reduces the output rather than amplifying it. Negative feedback is often desirable as it promotes stability in a system. An ingenious example of adding negative feedback to a system is the centrifugal governor invented by James Watt in 1788 to control of speed of his steam engine (used to provide mechanical motion, not a steam train). As the engine's speed increases the centrifugal governor reduces the engine's throttle and vice versa automatically.

In our paper on Stronger investment theory we discussed the feedback process of reflexivity that exists within financial markets. In this feedback process the actions of investors trading on expectations about a company's future changes the future of the company. For example, if investors expect a company to fail and re-price its stock accordingly this might impact the willingness of lenders to provide short-term capital to the business resulting in its failure due to a shortage of capital. Here, the expectations (company failure) of investors were met but their actions caused the company to fail.

Comparing biological ecosystems to the investment ecosystem

Some features of biological ecosystems map to features within the investment ecosystem while others do not. The structure and type of relationships between the entities in an ecosystem is important and this is one area where we can draw direct analogies between the relationships observed in biological ecosystems and the investment ecosystem.

The relationships within the ecosystem are created by the entity's processes competing for limited resources. In the investment ecosystem this limited resource is "access to capital". Note that it is not capital itself that is the resource being competed for as capital is always owned by the saver (or end investor). With savers as the true owners of capital, asset owners are entities that aggregate saver's capital and may, in some cases, compete for access to those savings. Asset managers then compete for access to the capital aggregated by the asset owner entities.

As an aside, sometimes asset managers are portrayed as competing for "alpha" (returns due to the unique skill of that manager in "beating the market") and while generating alpha is a competitive undertaking (it is a zero-sum activity before costs) the true competition between asset managers is for access to the capital on which fees are charged. Consider BMW and Audi: both build cars but they aren't competing for cars, they are competing for car sales. Akin to "generating" cars with different features, the generation of skill-based returns is a process that the manager uses to gain access to capital, just as different pooled fund structures are features that allow it to access different sources of capital.

Comparing different relationships with an ecosystem

The entities within an ecosystem interact with each other. These interactions can be classified into one of the following relationships:

1.

Predator-prey

This is a positive-negative relationship where the predator's benefit is the prey's loss. This is an ecosystem relationship that is most familiar from nature and probably the relationship that is first visualised when thinking about relationships in an ecosystem. It should be noted that in addition to the typical lion vs zebra scenario a predator-prey relationship also exists between the zebra and the grass on which it feeds. The key to understanding the sustainability of such relationships is to understand the rate of predation against the rate of self-replenishment by the prey

2.

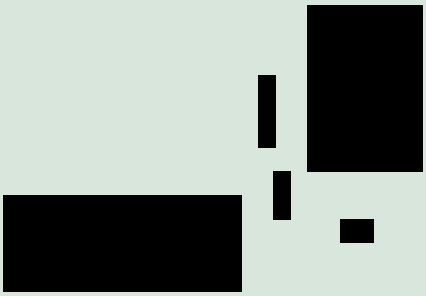
Competition

This is also a positive-negative relationship. It can exist between entities in an ecosystem (different species competing for a common resource, such as the same food source) and within entities (eg competition for leadership of a group). Competition between entities for the same resources may be based on their abilities independent of the actions of others (at least over short time scales) or it might involve one entity deliberately preventing another entity acquiring the resources it needs. When there is continued competition between two entities for the same resources within an ecosystem can both coexist? In ecology the "competitive exclusion principle" would suggest that ultimately only one will dominate the resource with the other going extinct or adapting to use different resources. However, many natural ecosystems are found to violate this principle. Possible reasons for this include high system dimensionality[2] and specialist-generalist trade-offs (alternatively referred to as competition-colonisation trade-offs) that may result in co-existence of similar species.

3.

Mutualism

A positive-positive relationship. Both entities benefit from the interaction. Examples include bees and flowers where the bee gets nectar from the flower and the flower is able to distribute its pollen via the bee. This type of relationship could be termed a "win-win" relationship and it would be expected that free-trade commercial relationships are of this type.



[2] Two entities may compete for a common resource spatially but over different time scales. If only the spatial dimensions are considered these entities appear to be in direct competition but this is not the case. In an ecosystem the dimensions of the system may include behaviour and relationships as well as physical dimensions.

Biological ecosystems also show "parasitic" and "commensal"[3] relationships between entities and while these may exist within the investment system it seems that these are much less common that the three described above.

Between asset owners and asset managers there is often a mutualistic relationship. The asset owner benefits as it is able to access the processes of the asset manager (its asset management ability) for less than the cost (both monetary costs and non-monetary costs such as inflexibility of process) of having those processes in-house. The asset manager benefits by having access to capital on which to charge fees. This mutualistic relationship can break down if the benefits to either side reduce. For example, if an asset owner is able to implement the investment management processes in-house for less that the cost of using an asset manager then this win-win relationship has broken down.

Between asset managers there is generally a competitive relationship. However, the specific processes used by asset managers dictates the relationship between them. When similar trading strategies are used this can create a predator-prey relationships between asset managers. For example if an asset manager is trading on corporate announcements at the end of the trading day and another asset manager deploys a new process that trades on corporate announcements intra-day there is now a predator-prey relationship between those asset managers. In contrast, other processes used by asset managers can co-exist with each other even though they are in competition. Value-based and trend-based trading strategies would be examples of such processes. The profits of one are losses to the other but both can co-exist in markets, and exhibit a level of co-dependency.

Although a mutualistic relationship is a win-win relationship it does not require a common objective or equal benefit to both parties to exist. Where a mutualistic relationship is desired, aligning interests (towards a common objective) can create one where it would otherwise not exist. However, rarely are interests truly aligned and imposing incentives can result in inequitable outcomes unless very carefully managed. In contrast there are also occasions where a mutualistic relationship cannot be avoided. In the investment system an example of this is corporate engagement or activism. In this case the actions of one investor to improve a company benefit that investor but those benefits are also experienced by other holders of the company's shares[4].

A win-win outcome for all investors from corporate engagement would seem a straight forward example. However, the discussion of the subject at the 2016 TAI London roundtable demonstrated that in the investment system things are not that straightforward. It was noted that the win-win dynamics create a free-rider problem that might encourage everyone to rely on others to do the work (receive the benefits without putting in the effort) and that there might be competing views about what a selected company should be doing, leading to competing corporate engagement agendas.

[3] In a commensal relationship one entity benefits while the other is unaffected. It is a positive-neutral relationship.
[4] One might also conceive of this as a parasitic relationship, where one entity "extracts" resources from another. In this case, the resource being extracted is the additional cost of engagement borne by one party (with benefits accruing to free-riders at no cost).

Properties and behaviours of an ecosystem

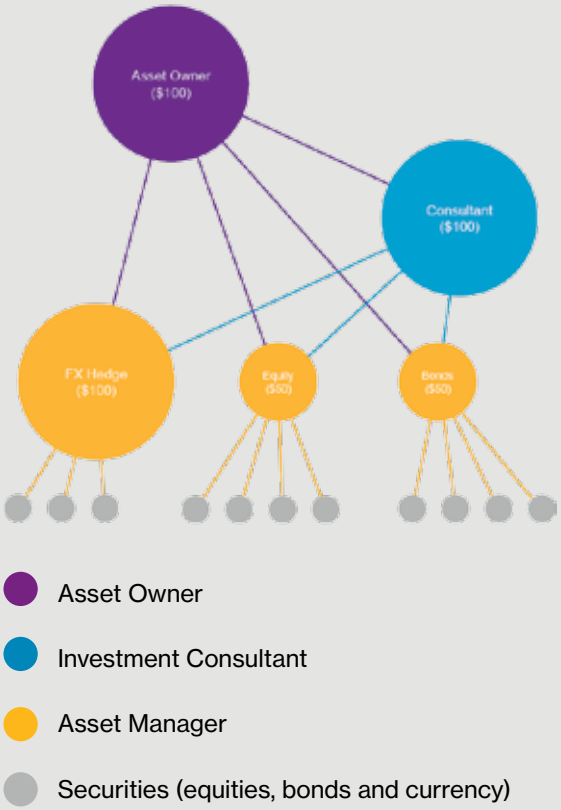
In biological ecosystems certain properties like the system's total energy and nutrients are conserved, while others (for example, populations or biomass) vary over time. While care must be taken not to overreach the biological analogy we can think about the investment system also having conserved and variable properties.

In the investment ecosystem resources are often conserved within the system but the total quantity of those resources can vary though time. The resource of capital has these properties. The total value of capital changes through time as prices move but the system's capital is always fully allocated across its entities. This means that the total value of assets changes over time and that all assets are always owned by someone. From this a number of features follow: firstly, while the capital of some savers can grow faster than the system as a whole the aggregate growth of all savers' capital cannot exceed the change in capital of the system. This has implications for how we view risk pooling instruments and derivatives that can be used to hedge changes in capital. These instruments can redistribute gains or losses between savers but they cannot eliminate losses. When capital value is impaired those losses can be redistributed but in aggregate cannot be avoided.

The entities in the investment ecosystem compete for "access to capital". While the amount of capital is limited (as described previously) the number of entities able to "access" the same capital simultaneously (to provide services and charge fees on that capital) is not, so long as the entities are providing different services. Consider the scenario shown in figure 2 where an asset owner with a $100 portfolio that uses an equity asset manager and a fixed-income asset manager, a currency asset manager to hedge the portfolio and a consultant to provide advice on the equity/fixed-income allocation. The total capital is $100. The asset owner has access to $100 of capital, the asset managers' combined access to capital is $200 ($100 of equity and fixed-income and $100 of hedging) and the consultant has access to $100 of capital on which it provides advice. These entities are competing for access to that capital with each other and with other asset managers and consultants.

As the asset owner, asset managers and consultant apply different processes (investment roles and time scales) they are able to co-exist on the same capital.

Figure 2. **Access to capital in a simple investment ecosystem.**



source Willis Towers Watson

An alternative representation of the same investment system could be in terms of the processes being deployed by each entity such as strategy selection, security selection, trading, reporting etc. This results in an investment-function network that reflects the components of the value chain, as discussed at a number of Thinking Ahead Institute events. Recognising that there are different ways for an asset owner to combine these functions and different providers of those functions the investment-function network shows the range of potential ways an asset owner could structure the investment functions it requires so it can maximise the likelihood of achieving its objectives. This might be an objective to minimise potential losses or maximise control, as well as more obvious objectives such as maximising value for money or maximising wealth.

The structure of an individual asset owner's investment-function network is likely to influence if and how it views in-sourcing or out-sourcing as a more attractive way of meeting its objectives.

How an ecosystem changes over time

Ecosystems are, by their nature, not static entities. Change is a natural part of any dynamic system and while ecosystems exhibit "resistance" (a measure of a system's resistance to change) and may be "resilient" (the speed with which they return to an initial state) this does not mean they are immune to disturbance. Ecosystems often appear to be stable but may change dramatically in response to a seemingly minor disturbance (as expounded in Hyman Minsky's financial instability hypothesis). Change in an ecosystem could be brought about from internal dynamics (endogenous affects) or an external influence/event (exogenous affects). Figure 3 shows examples of endogenous and exogenous effects in natural and investment ecosystems.

Figure 3. **Comparing types of change in natural and investment ecosystems.**

Type of change	Natural system	Investment system	
Exogenous	The introduction of a new species to a river or lake	New regulations imposed on a market	
Endogenous	Deforestation in parts of Kruger National Park due to actions by animals within the park	*Example 1:* investors withdrawing assets from a fund to avoid being too large a part of the fund's assets triggering additional withdrawals as assets decline	*Example 2:* excessive extraction of fees relative to value provided by asset managers, resulting in a flow of capital to low-cost strategies

source Willis Towers Watson

The key process that drives internal change in both natural and investment systems is evolution. In its most basic form evolution is a repeating process whereby differentiated traits are continuously selected and amplified.

In the context of the investment system the growth in passive investment could be viewed as the result of the system evolving based on the selection and amplification of traits deemed desirable by asset owners. The traits that asset owners are currently selecting (through capital allocation decisions) are low cost, transparent and high capacity approaches to capture market returns. This in turn is resulting in more "passive" offerings (the growth of ETF's being one expression of this) as these traits are amplified through the system and asset managers evolve by offering such products. It is important to note that the evolutionary fitness landscape, essentially a description of how desirable asset owners find current strategy/product/asset manager features, for investment products is not fixed but is, and will, change over time as the needs and priorities of entities within the system change.

Applications of systems thinking to investment

Viewing the investment system as an ecosystem can seem like an abstract idea. Hopefully, however, the examples of applying an ecosystem perspective to investment throughout this piece have demonstrated where a systems perspective brings greater insight and clarity.

The Stronger investment theory paper outlines the case for the investment system being an incredibly rich ecosystem comprising many different organisations (asset owners, asset managers, banks, individuals, governments, companies) that simultaneously cooperate and compete with each other. They do so using a changing technological toolset (including social, cultural and legal technologies) to transact in financial markets (both public and private) in order to further the objectives of their respective organisations. The paper characterises the ecosystem it describes as a complex adaptive system due to interactions of the many participants and the evolving nature of the system itself.

Likewise the State of the industry papers reviewed the investment system in aggregate and explored a number of future scenarios that might unfold and how different forces could reshape the industry. Exploring these potential scenarios required mapping the present state of the investment ecosystem, establishing how different parts of the system are likely to evolve and how the system could potentially respond to changes in both its components and how they interact. This type of analysis requires a system perspective as changes to one part of the system affect the others and so how a small part of the system evolves cannot be considered without assessing the change to the system as a whole – much in the same way that small changes in a biological ecosystem can have a system-wide impact.

Developing an understanding of the investment system

This paper has introduced the concept of an investment ecosystem, it has explored some basic ecosystem ideas and principles, and it has demonstrated how they manifest themselves in the investment system.

By recognising that the investment system is a complex adaptive system which shares some generic behaviours and traits with other ecosystems, some of the more abstract complex system ideas (for example, fragility, feedback, adaptation and non-linear systemic responses) may be more easily applied to, or at least recognised within, the investment system. The drawback of not using a system wide perspective is that actions are considered in isolation.

As shown in the examples the hard-to-manage risks and forces that shape the investment ecosystem (including financial markets) are not observed in isolation. These are often phenomena that emerge from the behaviour of the system as a whole due to the relationships and interactions of its entities. To understand and manage these a system approach is required.

Applying an ecosystem perspective to investment allows techniques from game theory, network/graph theory, evolutionary biology and system dynamics, management science, neuroscience/behavioural finance, and anthropology to blend with finance domain knowledge in a coherent manner. Otherwise, these disciplines are typically regarded as separate fields of study and not relevant to the financial perspective. An example would be using game theory to predict how market participants respond to incentives. This will yield a likely course of action by the participants. However, if the analysis does not also consider that the participants' actions may not be strictly rational and that the participants may be able to change the structure of the pay-offs as the system evolves it may not give a good indication of how participants will behave. Investigating such unintended consequences is a natural part of the ecosystem perspective as we expect the system to evolve. To summarise this example, while game theory might indicate the players' next moves, it is the ecosystem that decides what game is being played at a given point in time.

To better achieve their objectives in a complex adaptive system, participants need to utilise a multi-disciplinary approach to understanding, and managing, the system. By understanding the system a participant can begin to utilise the coping strategies of self-awareness, meta-awareness (ie awareness of others' motivations and relative competitive positions), change adaptability and strength of culture to prosper within the system. The ecosystem toolkit provides a natural way to apply those multi-disciplinary techniques to the investment system, and thus ensure that a participant's organisation is able to thrive (exceed its goals), or at least survive (for example, meet future liabilities), in a future where change in the system is inevitable.

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About the Thinking Ahead Institute

The Thinking Ahead Institute seeks to bring together the world's major investment organisations to be at the forefront of improving the industry for the benefit of the end saver. Arising out of Willis Towers Watson's Thinking Ahead Group, formed in 2002 by Tim Hodgson and Roger Urwin, the Institute was established in January 2015 as global not-for-profit group comprising asset owners, investment managers and service providers. It has over 40 members with combined responsibility for over US$13 trillion and aims to:

- Build on the belief in the value and power of thought leadership to create positive change in the investment industry
- Find and connect people from all corners of the investment world and harnesses their ideas
- Work to bring those ideas to life for the benefit of the end saver.

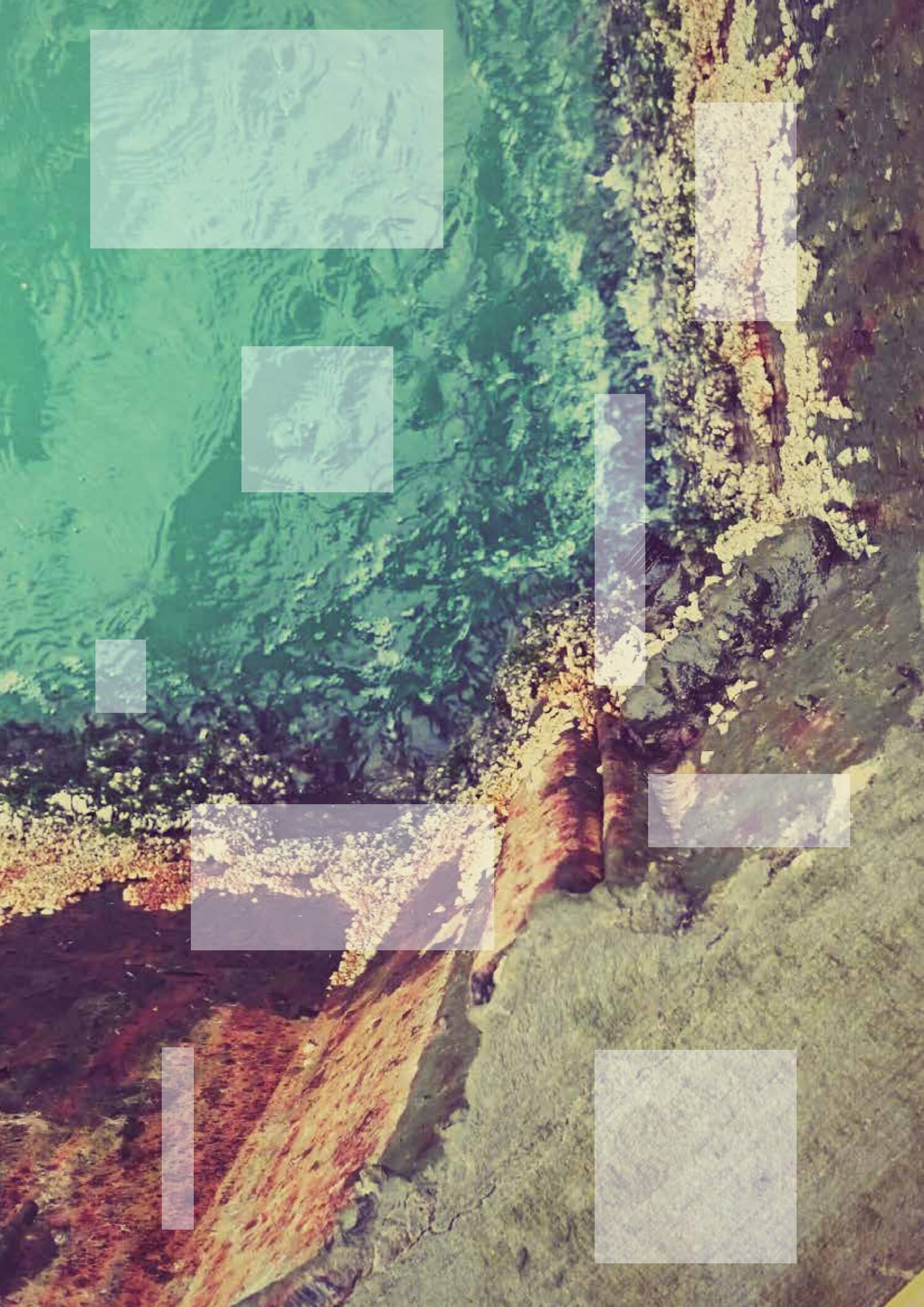
At the Institute we identify tomorrow's problems and look for investment solutions, which, we strive to achieve through:

- A dynamic and collaborative research agenda that encourages strong member participation through dedicated working groups
- A global programme of events including roundtable and key topic meetings, webinars and social events
- One-to-one meetings between Institute member organisations and senior representatives of the Thinking Ahead Group.

The solutions we collectively develop fall into three overlapping areas:

- Better investment strategies
- Better organisational effectiveness
- Enhanced societal legitimacy.

This framework guides the Institute research agenda and the desired output of each research project. The Thinking Ahead Group acts as the Institute's full-time executive. The Institute has a governance board comprising both Institute members and Thinking Ahead Group representatives.



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