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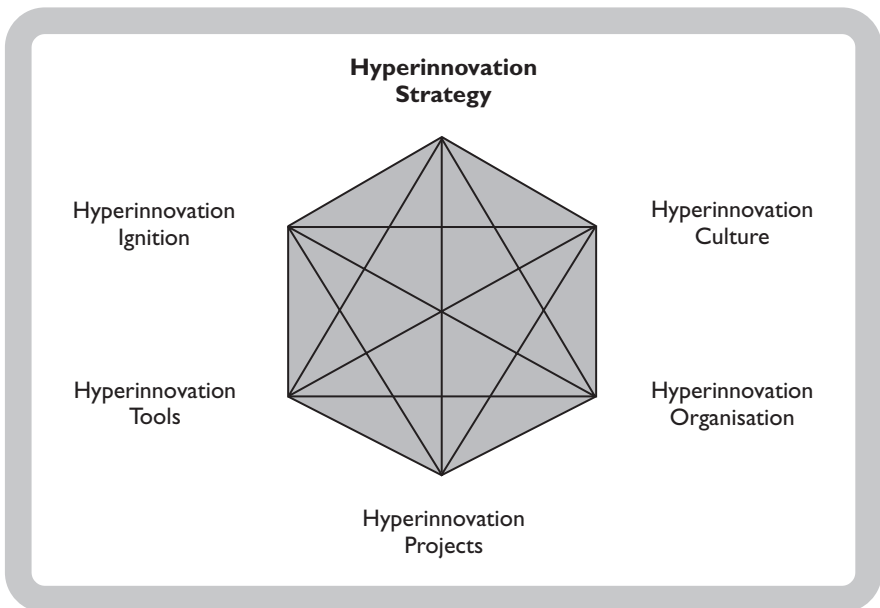
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PART I

Hyperinnovation Strategy



So how will the telcos – and others – make enough money for profit, R&D, and systems maintenance? By expanding what we consider a telephone to be... This is easy to do in a network economy because the crisscrossing of ideas, the hyperlinking of relationships, the agility of alliance, and the nimbleness of creating nodes, all supports the constant generation of new goods and services where none were before.

KEVIN KELLY

The business world not only operates at a faster pace than ever before; it is increasingly diverse and interdependent. For now change not only arrives without warning, it occurs on multiple fronts. Markets not only disintegrate before maturity, they extend across unknown territory. New technology is not only obsolete within months, in its wake it obliterates long-held economic assumptions. The effect this interdependence and rate of change give is a somewhat ambivalent proposition. On the one hand, a world made of greater opportunities and possibilities for new kinds of enterprise and growth; on the other, a frenetic and deeply perplexing order that demands a complete rethink in terms of the strategies for innovation.

Enter: Complexity

Picture a computer screen. Now imagine a large random group of virtual Chameleon-like characters programmed on that screen, each designed to display seven colours of the rainbow. Each Chameleon at that point displays one of seven colours of their choice, and if this were true, of course each would be a slightly different shade of colour. So what do we have? If you were looking upon this crowd of virtual Chameleons, you would see a random mixture, awash with colour, with no real discernible pattern. But now introduce *one simple rule* into the programme: each Chameleon must adapt – again at random – to the colour of a neighbouring Chameleon. Now what happens? Well, it's something quite amazing. Each Chameleon instantaneously attempts to change to the colour of its neighbour, but as they change, their neighbours also change. Further, their neighbours change to the tune of some other neighbourhood, and that neighbourhood to the tune of yet another neighbourhood. If you were still looking at this colourful network of virtual Chameleons, you would see something quite beautiful, you would see cascading fractals, swirling round and around, continually unfolding in complex patterns. This virtual network would never settle down to one colour, but continually unfold in evermore *novel* arrangements.

A more interdependent world means a more complex world, and what better way to comprehend how this new era functions, than through a science of complexity. Specifically, complexity science is concerned with understanding how a collective of large numbers of interrelated agents behave as *one whole*. Agents can be any independent body; examples are atoms in a molecule, neurones in a brain, virtual chameleons on a computer screen, or here, connected innovations in a marketplace. Under this scheme, agents, in whatever guise, begin to form dynamic linkages, which in turn build up in cascading energetic order. A dynamic order of self-organising patterns.

The great news, however, is that the self-organising dynamic found on a computer screen, is in fact now applied science in disciplines as diverse as traffic control, materials science and artificial intelligence. What has been discovered in such complex systems, both on the computer screen and in the real world, has far-reaching consequences for business. We unequivocally now know that:

- Large numbers of independent agents, interconnecting to the tune of a few simple rules, can give up the most extraordinary and counter-intuitive products; astounding results not found in those many constituent parts.
- *Order* can emerge for *free* from the inside out, without any top-down planning and control. But no common kind of order, instead patterns more intricate and profound than anything yet devised.
- There is amazing potential for unique combinations among agents, such as ideas, leading to unending possibilities for innovation, whether in business, or in any discipline you care to mention.
- It also begins to give an explanation of how the quite amazing diversity and elaboration we find in the natural world emerge, and now in our rapidly complexifying man-made world as well.

This simple introduction to complexity sets the stage for the first part of this book. In fact, complexity science gives an extraordinary insight into the way the business world is set to work from now on, particularly concerning the dynamics of innovation. The insights are straightforward, yet at the same time profound. When we look at many of the emerging areas of technology, even the markets and wider societies they produce, we not only see levels of complexity, approaching that found in living-breathing-biological ecologies, these man-made systems actually begin to

mimic basic architectural structures and behaviours found in nature. By comparison, the markets of the past will appear like barren tundra; the markets of the future will mimic richly intertwined tropical ecologies, chock-full of colourful, interconnected products and services, exhibiting ingenious competitive strategies and proliferation tactics. As we shall explore in this first part, as the business world approaches such elaborate complexity, the whole dynamic and rules of the game for innovation fundamentally transform.

Multidimensional Innovation Strategies

Under this setting, the smartest and most effective way to understand and direct the new dynamics of innovation, is to engage the sciences of complexity. Accordingly, this first part outlines five strategic management concepts based on complexity science, that enable multidimensional innovation:

Chapter 1 – Thriving on Paradox: In the past, when industries were independent and clearly demarcated, we could anticipate the future and its consequences with some degree of confidence. In this linear world, outputs rolled away from inputs in a reasonably consistent fashion. By contrast, in a complex world, whether an ecology found in nature or interconnected markets now found in commerce, outputs and inputs begin to stray, behaving in counterintuitive, sometimes paradoxical ways. And there is no hiding from this. As the links between once disparate business concepts grow, there is a mandate for new management strategies that thrive on the paradox that such complex systems exhibit. This chapter introduces abstractions of complex systems as applied to innovation, describing the key strategies necessary to prosper in interconnected and paradoxical times.

Chapter 2 – Multidimensional Thinking: Serial thinking is the pervasive, perhaps pre-eminent mode of thinking today. Yet serial thinking can lock us in an equally linear context out of touch with the market realities described in the first chapter. In fact, linear thinking can so limit our perceptions that we are utterly blind to the highly novel business contexts emerging now. The second chapter outlines, and arms managers with, the mental capacities for a multidimensional business world. The thinking modes of *contrary perspectives*, *counterintuition*, *uncommonsense* and *strategic serendipity* are described.

Chapter 3 – Multidimensional Learning: In a world that changes without warning, and in a multiplicity of ways, there is a need to accelerate market learning at least at pace with the competitive context. Again,

lessons from the complexity sciences give us the strategies to learn what the market is selecting for in real time.

Chapter 4 – Multidimensional Enterprise: The past was marked by the specialist enterprise, targeting narrow market segments, with well-defined steady-state technology. Today, we see the emergence of a new kind of polymath: multidimensional enterprise. Marked by diverse competency, technology and market panorama, this is a fresh kind of operation that is already redefining the competitive ground rules. Here, the strategic concepts of such enterprises are described.

Chapter 5 – Collaborative Commerce: To realise multidimensional enterprise, companies will have to work with other, sometimes unusual, organisations normally outside the fold. This chapter describes the basic building blocks for achieving such collaborative commerce.

All told, multidimensional innovation rewires the philosophy and theory of business innovation strategy as we have known it. Hyperinnovation sits as a true breakthrough, serving as the edge of today's strategic practice.

Thriving on Paradox

The unavoidable difficulty with convoluted webs of innovation, is that these systems – like all complex systems – begin to exhibit paradox: behaviour and outcomes that seem absurd or contradictory; yet they are in fact well founded. Specifically, *perpetual novelty*, *constant surprise*, *acausality*, *uncertainty and discontinuity* all sit as unavoidable, yet often desirable, consequences of the kind of complex markets and technology now emerging.

Valuing, indeed thriving on the corollaries of interconnection, may be the business world's most pressing challenge. Because if you think the world is complicated right now, you can only imagine what it is going to be like tomorrow. Thus, the biggest risk for any enterprise, indeed any institution, is to continue with convention, to use the management mindsets and strategies that worked effectively when markets, technology and all else, were considerably more steady-state and autonomous. High risk, because routine linear thinking, and top-down methods of planning and control, unequivocally do not work in the complex breeds of trade looming now. Consequently, it is imperative to seek and develop new and relevant strategies that *thrive on paradox*.

The First Principle of Hyperinnovation

Many moons ago, a tutor of mine gave up the fact that a student studying science at high school has the opportunity to learn more about the laws of physics than the great Sir Isaac Newton ever did, or could have known in his time. Since that day, I have long wondered how knowledge develops, how ignorance can blossom to enlightenment, how seemingly mystical breakthroughs in understanding come from simpler, less structured under-

standings, but more, how complex innovations originate from much lesser innovations. After much thought and deliberation over the years, it became clear that the answer may lie in the *many potential interconnections of ideas*. To gather a perspective on *how more comes from less, through hyperinnovation*, we can look back to a time when one of today's most ubiquitous consumer products was just about to break through.

The year, 1931; the place, Alexandra Palace; the innovation, the television. And to be sure it captured the public imagination. The police would at last have a medium to transmit pictures of wanted criminals to remote parts of the land. Most exciting of all was the prospect of 'moving picture home entertainment', they thought. Still, much of the press saw it quite another way, as this 'white elephant' simply required far too much sophisticated technology and investment for successful commercialisation. At this time perhaps the very rich and a few critical commercial applications could afford such grand technology. But look at it from a 1930s point of view. Market penetration and ultimate commercial success would take a vast corporation to make the television programmes, with the aid of far-sighted financial investors and sponsors. It would require a body of top minds to develop the physics of the core technologies, and scores of top brains to design the TV sets themselves. Next, a vast network of transmission centres and a multitude of hill-top antenna to transmit the signal to each home (or community centre as first proposed). On top of this, vast sprawling factories would be needed to manufacture the TV sets, with a supernetwork of partners to supply the materials. And then on to the distribution channels, in association with a maintenance force comparable to an army. Oh yes, then there is the power supply from the national grid, it would simply double power demand at peak times... Of course, none of this was so clear, as the 20/20 hindsight we have now.

Let us turn the headlights forward to give a perspective on all this. Holographic television becomes a serious technological proposition when optical transistors, microlasers and the equivalent of today's supercomputing are commoditised. High-quality colour three-dimensional TV pictures that you can wave your hand through. Yet, what technological and commercialisation adventures lie ahead? Again, I hear commentary (much commentary), that such an invention will be far too costly to commercialise. It will take... Well, all of the above and no doubt much more.

And *more* is the point here: it is not a free lunch – technological research, and ultimate innovation, is a saving account born of successive interconnections amid both mature and contemporary technologies and/or discoveries that accumulate a greater whole. In short: it is a synergy among known and novel, diverse and local, but quite often disparate ideas

that give the bigger, different, more sophisticated technology... In a word: it is all in the *interconnections*!

In fact, when we observe what emerges from these kinds of complex systems of ideas, we find that the output or whole activity is greater than the sum of individual agents: $1+1+1+1=6$? Synergy in fact (the secret: four agents in a network have six possible interconnections). The underlying mechanism here is the space of *innovation possibilities*, the actual number of unique innovations possible from a finite or growing set of agents in a system. In mathematical terms, for every agent that joins a network, so the number of new interconnection possibilities, and thus innovations, goes up dramatically. There is in fact a principle of innovation at work here. I call it *the first principle of hyperinnovation*:

$$H_p \propto I_m \cong \frac{1}{2} * \sum \alpha^2$$

The potential for hyperinnovation (H_p) is proportional (\propto) to the number of meaningful interconnections (I_m) between agents. Meaningful, as in those interconnections that hold a level of perceived or authentic value.

As an indication of the potential for hyperinnovation, the number of possible (meaningful or otherwise) interconnections, is towards (\cong) one-half the square of the sum of agents in a network ($\frac{1}{2} * \sum \alpha^2$): 10 agents in a network would have 45 possible interconnections. One hundred would have 4950 possible interconnections. One thousand would have 499,500 possible interconnections. One million agents would have over 499 billion possible interconnections.

The payoff: for every new scientific discovery and consequent technology coupled to a network, so the number of innovation possibilities increases dramatically, so driving the synergy among ideas further and faster uphill. And so accordingly, a flourishing variety and correlation among ideas, knowledge, technology and market demands, are the spur for creativity and innovation. The more diverse and interconnected an invention – whether a core technology, a service provision or an entirely new business platform – the greater the inherent value and potential for yet more innovation.

Develop a Passion for Perpetual Novelty

The new is strangely familiar these days. In the consumer arena, we are now witness to the most prolific stream of gadgets and gizmos, flooded by new tools and toys, to a point that almost overwhelms. In medicine, we hear of continuous breakthrough, in science the limits and power of human know-

ledge now boggle the mind. In every conceivable industry and field the rate of innovation has reached stupendous heights... Only, I do not want to perplex you with examples and facts here, as I am confident that your immediate experiences are testimony to increasing rates of change. The point I want to make is a further fundamental reason for all this innovation, and why in particular this reason is radically transforming the rules of the game.

A dominant, yet not so well-known trait of any sufficiently interconnected system is *perpetual novelty*. Whether it be an immune system, an ecology, or network of ideas, novelties reliably emerge with vigour. As above, the deeper the complexity, the larger the space of potential combinations for novel patterns to emerge. And since markets now organise and behave like a complex system, it follows why novelty is reaching epidemic proportions. Therefore, we must at some rudimentary level, acknowledge that novelty is not only omnipresent in the arcane world of complexity science, but flush in reality too. To give an active insight on the dynamics of perpetual novelty, consider what M. Mitchell Waldrop wrote in his inspiring book *Complexity*:

it's essentially meaningless to talk about a complex adaptive system being in equilibrium: the system can never get there. It is always unfolding, always in transition. In fact if the system ever does reach *equilibrium*, it isn't just stable. It's dead. And by the same token, there's no point in imagining that the agents in the system can ever 'optimise' their fitness, or their utility, or whatever. The system space of possibilities is too vast: they have no practical ways of finding the *optimum*. The most they can do is to change and improve themselves relative to what the other agents are doing. In short, complex adaptive systems are characterised by *perpetual novelty*.

So what does this cool scientific perspective give?... Evidently, it says that *new stuff* happens. But between the lines, it hints that the all-consuming love affair we have with efficiency (optimisation) and tight control (equilibrium), is not only short-sighted, it leads blindly to extinction. Any so-called efficient organisation (business or otherwise) set in stasis cannot live with the novelty that now surges throughout markets, since frigid, isolated systems can neither anticipate, nor perpetuate, innovation.

The logic is this: in the past, the reflex has been to stamp out novelty; but suppressing novelty only destroys the very mechanisms that keep the system (your business, your technology, your markets, your customers) alive and well. If a system is characterised by little or no change, it means that the system is in equilibrium and near death (as above). And this is a recurrent tale: firms exhibit permanence and homogeneity, where nothing

much changes, hence the system at large is at best listless, at worst approaching its demise. What is more, many a good manager considers smooth equilibrium as a clear objective, as equilibrium is innately seen as necessary for normal operation. It means high levels of order, of certainty, of peace of mind. It means that things will change gradually, and therefore controllably. But look at any company that is heading for equilibrium, and that firm will be out of touch with *live* competitive context. They will find it difficult to respond, let alone anticipate new market permutations or competitive eccentricities; and we have to remind ourselves that it is often a curious irregularity or unique combination of technology that kick-starts the next big market wave. And as for being up with the technological and/or market elite, a firm resting in equilibrium will not even be able to identify what is truly current, let alone the direction of market evolution. The inroads for the collection of market and technical information will be somewhat obstructed, its dissemination moderate, and the interpretation shallow.

The reason is that equilibrium, in the form of highly ordered command structures and functions, signifies that a firm has begun to ossify, its agents are stabilising. Which means a firm has become set in its ways, choked by old dogma, blind to what is new and germane to the market. Xerox, back in the 1970s, is one case in point. Xerox endeavoured to outline the major technological breakthroughs (for example lower cost microprocessors), the major shifts in customer demands (for example sophisticated documents), and new competitors' innovations (for example Canon's reliable, easy-to-use copiers), but even after its strategists produced report after report, Xerox was so concerned with tight command and control, so poised in stasis, that it was sapped of the ability to recognise and exploit such major shifts. And shift it did. The pursuit of equilibrium has taken Xerox and others like it (IBM, Chrysler, Kodak and Sears) to near death's door on more than one occasion, and in industries that have developed and burgeoned like no other.

Hand in hand with the pursuit of equilibrium, is the quest for *optimisation*. Ratcheting up productivity, incrementing costs down, polishing quality and honing core service, was how the corporation made great wealth. This wisdom brought with it intensified learning curves and economies of scale; focused learning meant better understanding of the technology and market; scale economies led to lower unit cost, lower unit cost led to greater margins. So the logic went. This is optimisation at its very best, and so ingrained in management mindsets, that anything else is seen as ambiguous and frail.

But optimisation, in the final analysis, will never harvest a constant stream of innovation. First, it is quite impossible to sustain superior value by optimising old ground, as sharpening aged products and practice

quickly leads to diminishing returns. Second, optimisation never (ever) leads to any radical innovation, as continuous improvement of prevailing products, services and their processes is always a fast track to bland mediocrity. But most of all, the innocent and well-intended endeavour to become the very best, will quickly fall prey to someone, or something, or some company, that is thinking, tinkering and doing something *different*. Whether in sport (Tiger Woods), or business (Amazon), or war (SAS) or politics (New Labour), someone, somehow, someday (soon) will blow the roof off what is thought possible because they act and perform in distinct and unique ways. It is not enough to seek *excellence* any more (as momentous as this goal used to be), a firm must now be superlative at fundamentally reinventing itself, to be sustainably different. Paradoxically, to be truly the best, an individual, a team, an enterprise, needs to be altogether different. And to be different you have to focus your attention on quite different issues. In short, in a perpetually novel world, you need to be perpetually novel yourself.

Clearly, there is much to learn and do, as the consequence of the dogmatic, ubiquitous pursuit of efficiency (optimisation) and tight order (equilibrium), is that innovation is not only held back, it is stopped in its tracks. In fact, these convictions are so deep-seated in corporate culture and places of learning (I find), that they flagrantly interrupt the aspiration to build new competitive strategies that pre-empt novelties in the market. Therefore, it is essential for leaders to adjust attitudes and priorities in strategy development. To enlighten teams to the shortfalls of *efficiency* and *tight order* when *perpetual novelty* is both the *goal* and *behaviour* of the competitive context. In sum, we must all *develop a passion for perpetual novelty*, if we hold any chance of sustained competitive advantage through hyperinnovation... Here are four strategic goals that may kindle such a passion for innovation:

- *Spend more time on innovation issues.* It is not that the pursuit of optimisation is neither worthy, nor illogical. It is just that management tend to over-direct and value optimisation over innovation. That is, the emphasis on cost-cutting or continuous improvement and the like, is so apparent in benefit, that the idea of creativity and innovation is seen as some second-class activity. But facts are facts, innovation is several orders of magnitude more difficult and time consuming than slicing a penny or two off unit cost. Yet the proportion of time spent on innovation is far far less than cost containment projects. Look at your diary, look at your people's schedules – it is optimisation driven, isn't it? The solution is straightforward, but not easy. Measure time spent on both

optimisation and *innovation*. If you are not meeting a 20/80 target respectively, you are not in the game.

- *Exceed your best innovations.* As the marketplace, and all within, coalesce, we can only expect to see ever more distinct competing technology concepts and business platforms. Like it or not, many of the finest, most remarkable innovations of the day – your innovations – will end up as mere junk before much later. This is precisely because established domains in complex networks tend to disintegrate suddenly, and then, in turn, are replaced with fresh patterns of connections. Consequently, there can be no sustainable competitive advantage, unless there is a mandate to supersede the established model with a more progressive and germane innovation. The late Akio Morita, co-founder of Sony, often said, ‘If we want to sustain value in the market, we have to become our own best competitor’. As tough and as risky as it sounds, the ability to kill your innovation, even at its peak, with a finer, different, more consummate innovation, is the only way to compete with incessant novelty in the market. Set a goal of exceeding 50 per cent of your best-performing innovations, over the next three years.
- *Renew half your business activities over the next five years* (whether IBM or a mid-sized company). We often forget that end-product and services are not the only agents we must supersede on a continuous basis. Enterprises need to execute unaccustomed operational activities too. And that means strange ideas, unfamiliar competency, fresh functions, new people and diverse technology. Embrace this, get used to deeds anew. So, measure how much of your business – core capabilities, skills, tools, knowledge, processes, people – are less than five years old. If well over half of your business activities are more than five years old (five months in e-commerce), novelties in the market will negate your brightest efforts.
- *Equilibrium is death, but too much change will kill with equal effect.* Turbulence and variation are what give rich life in nature’s garden, but too much can destroy an ecology outright. Small-scale upheavals make way for new seeds, larger-scale catastrophes uproot and destroy genes and species. So how much or how little? What is the crucial point that causes a system to crash, freeze up or perpetuate? Every complex network (whether biological or technological) is a distributed web of nodes always in flux, always in the process of adapting itself. It is the same for business systems at all levels, whether hypertechnology, multi-dimensional markets or inter-industrial arenas. The secret is to let the

system emerge in its own particular order for free. Too much innovation will crash the system, too little will freeze it. So keep searching through different levels of complexity to actively make your innovations more diverse and interconnected. Various methodologies are outlined further in Part V, to achieve a suitable level of variety and interconnection.

The business world is now an evolving, unceasingly expanding system of interconnection possibilities: a *perpetual novelty machine* of constantly shifting patterns. Therefore, there is little room for excessive optimisation and equilibrium from a competitive perspective, only a boundless search across vectors of more imaginative orders of innovation. And there is no stopping this, novelties will arise in your markets whether acknowledged or not. So the business manager's first capacity from now on is to seek, expand and exploit this new-found paradox: *perpetual novelty*.

Seize on Constant Surprise

In the mid-1980s, I was tasked with benchmarking, and finally selecting, a computer-assisted design (CAD) system for GTE's European Lighting Products Division (divested as Sylvania Lighting). The proposition was a multi-million dollar investment, panning eight business units, the length and breadth of the continent. As a young engineer, I took on the assignment with verve, embarking on a tour across Europe and the United States. Compiling the system's technical specification was reasonably straightforward, a list of functional performance targets set against a list of tasks performed in each business unit's design process. Remarkably, the processes across each business unit were fairly uniform. This was my first surprise... The next task was more arduous: selling a *single* pan-European system to each business unit's management team. The reasons were just (they thought): *optimisation* and *equilibrium* across divisions! I did not anticipate any of this to be an easy buy-in, but I did expect the technology per se to be welcomed, as it would give at least an order-of-magnitude improvement in R&D productivity. But no! The reactions were quite different, and sometimes indifferent. The Italians were concerned that such tools would lead to cutting headcount (at that time, a sensitive issue due to the national political climate). The French already had a CAD system (a French system), and saw no reason to change. The Dutch claimed they were not ready, that they needed to put their design process in order before such investment could be justified. The British, like the Italians, were also concerned with job losses. All this rebuttal was due to a complex set of indirectly related operational and polit-

ical issues not, at first, apparent in my analysis, nor in my remit as a young engineer. All this was my second great surprise... Some years later, while actually implementing another CAD system, came a third, but pleasant surprise. That CAD systems create valuable work, not cut work. Computers – from internets to the microprocessors themselves – have led to a quite amazing and unexpected amount of job creation, not a decline as originally predicted back in the heady days of the 1980s.

Another challenge with complex systems is that they are often *irreducible*; the very act of stripping a system down to its component parts, destroys the very essence of what the complex system actually *is*. As Socrates was supposed to have said many times, cut an elephant in half, and you do not educe two elephants, but one great entangled mess. Now consider the mainstay of how management attempt to understand and control complex projects like the one above. They try to break the system down into measurable and manageable parts, then hand out each bit to a problem solver. But in doing so, managers lose sight of what they are attempting to understand in the first place. As day-to-day assignments and tasks become more complex, requiring more hands on deck to give up solutions, the very distributed conclusions themselves often lead to completely unexpected tasks, situations, opinions and so on. In brief, interconnected systems give rise to *continual surprises* too. Even when we break a system down to get to its roots, we cannot see all the surprises, snags, contingencies, spanners in the works, coming. In complex systems, even subtle things can blow up in your face unexpectedly.

Yet, what is the nature of a surprise in the first place? A surprise is merely the end result of a prediction (conscious or otherwise) that has failed. Predictions are made by working out and following a commonsense set of rules of thumb learnt through experience or teaching. But in a complexifying world, identifying the rules of thumb is not always possible, because (a) the rules of the game are always changing (perpetual novelty), (b) the system is always redefining itself (more perpetual novelty), and (c) you cannot always acquire every piece of relevant information (uncertainty below), so events do not always turn out as we project.

John Casti, a fellow of the Santa Fe Institute, New Mexico, has carried out much research into the anatomy of surprise in complex systems; concluding, like my experiences above, that we cannot always anticipate, or deliver outcomes as we like. In his book *Complexification* Casti wrote:

Complex processes, on the other hand, generate counterintuitive, seemingly acausal behaviour that's full of surprises. Lower taxes and interest rates lead to

higher unemployment; low-cost housing projects gives rise to slums worse than those the 'better' housing replaced; the construction of new freeways results in unprecedented traffic jams and increased commuting times. For many people, such unpredictable, seemingly capricious behaviour is the defining feature of a complex system.

But should we not be seeing less of the unexpected, you may ask? As technology evolves, should the world not get more ordered, and therefore more predictable? Do things not get simpler anyway? Does technology not shrink and become easier to use? Is it not much easier to travel further, faster these days? Can I not talk to people around the planet at the push of a button? Is productivity not way up?

Yes, of course, on the *surface*, things do get ever simpler, easier, faster, better and more productive. But under the skin of any object, inside the structure of any system, lies deeper embedded, more entangled complexity to produce such efficiency and refinement. Think of Intel's micro-processor. Its processing power doubles every 18 months, but the number of transistors per unit square, also doubles in that same time. The television has burgeoned in functionality when compared to models a mere 10 years ago, but to achieve this expanse, ever more and different technology is packaged inside the same or smaller volume of space. Pharmaceuticals embed deeper complexity. The latest drugs are designed via so-called non-rational design techniques, resulting in synthetic chemical molecules approaching the complexity of that found in biology. To be sure, the future of all technology is smaller and more refined towards the nano-scale, with ever greater functionality and interconnectivity. But complexification does not stop at the molecular or core technology level, it also occurs at the system-wide level as well. Because as increasing numbers of interdependent technological systems, such as airports, road systems, and computer networks continue to complexify, they only tend to reinforce and complexify each other further. For instance, if Heathrow airport grows, so Hong Kong and JFK reciprocate. If inner-city road systems swell, so all adjacent urban road systems expand. If one internet file server capacity grows, so all servers have to keep up.

And no wonder surprise is rife. No wonder unexpected events happen more frequently. The business world is now so interdependent, our contraptions so complex, that any attempt to reduce them and understand them in their constituents, is a false and wasted endeavour. Because when the business world and its inventions become interconnected, the old Newtonian model, where each and every event had an equal and

predictable outcome, is supplanted with a nonlinear dynamic, where each and every event may have an unequal and unexpected consequence. I am sure the great Sir Isaac would turn in his grave if he knew what was emerging: as our contraptions and markets, and the world in turn, become increasingly interconnected, expect more of the unequal and unexpected. Surprise is a consistent tenet in a multidimensional realm.

So, what is there to do here? How are firms supposed to manage amid such surprise? How can you thrive on this kind of paradox?... Fortune, it is said, often favours the prepared mind. And that means, at least in today's growing reality, galvanising a mindset that accepts surprise as not only a fact of business life, but as real bounty. As a real gift! Here are three basic strategies that begin to attune to surprise in interconnected markets:

- *Time to insight.* There's a principle in rapidly evolving markets, that says, as the *number* of competitors that *recognise* the same opportunity goes up, so the value of that opportunity falls towards a commodity proportionally. Hence, the *time* it takes to *identify* an unexpected opportunity is a key to sustaining value. And remember, it is often the novel eccentricity or unexpected combination of technology that kick-starts the next killer application. To accelerate time to insight, there is a need to perceive the subtle initial condition, the weak signal, no matter how faint, before it begins to swell and amplify. To begin to do this, there is a critical need to relentlessly gather new knowledge and data outside your fold. That is, look outside the normal boundaries of your current technologies, markets and industry. Look for ways to think and learn differently. Look at the edges of life, look at what is new and unfolding. Find underground or emerging culture, such as nascent music, radical books, outspoken people, extraordinary incidents, outlandish issues. Within all of this, search for novel patterns and trends you would not have readily acknowledged before. These are surprising sources of fresh insight. And remember, that a surprise is a boon if a firm is in a position to capitalise on a novelty that the competition is not aware of yet.
- *Time value.* Once an insight has occurred, there is a *time value* attached. Unexpected events in the real world can ignite or extinguish the value of an new idea literally overnight. Sudden incidents, like major disasters, can lead to abrupt economic down-turns, geopolitical rifts, even new legislation that literally washes away value. New technology, we know, can suddenly level a working business model. Digital technologies, for example, have put waves of ideas, knowledge and skills out of work in as little as a few months (XML being a case in point). On the other hand,

an unexpected occurrence can increase and/or give longevity to the value of an insight. Surprise events can also have a positive effect on value. Clearly, the ability to capitalise on insights, in shorter time frames than the competition, is a key strategic issue today. But this is not merely about *speed* per se, it is about developing an ability to anticipate, and to do that, an organisation needs to develop a learning disposition.

- *Learning disposition.* In the wild, many of the most successful species are opportunists lying on trees, in thick undergrowth, hidden under rocks in pools. Yet they are no ordinary opportunists, they are perfectly adapted to the environment to the point of invisibility. And this is exactly why they are so successful: over millions of years they have learned and adapted to shifting competitive conditions. It is the same for an enterprise, learning and adaptation are key to thriving on the paradox of novelty and surprise. Like the network of virtual chameleons in the introduction to this part, as the colour of the market changes, an enterprise must change its colour in synch; as that business's colour changes, the market modifies in response. Yet developing a learning character that can adapt an innovation strategy with such agility, can be fraught with scepticism, even out-and-out cynicism by those of the tight-order (optimisation/equilibrium) school. Only by acknowledging that the market is awash with novelty and surprise, will constant, sometimes naive, learning be seen as a strength. The key factors here are not only in the kinds of market learning strategies you develop, but in the kind of organisational culture you build (Chapter 7).

In sum, *seizing on constant surprise* boils down to learning and adaptation in synch with the real world in real time, outside the normal fold. We shall be revisiting learning and adaptation throughout this text, particularly in Chapter 3, where we will master learning in multidimensional markets.

Leverage on the Certainty of Uncertainty

There are three frustrating paradoxes tied up with forecasting the future. First, firms really only need to predict the future when major shifts occur. That is, if events and scenarios pan out with little or no change, a firm would not need to forecast the future in the first place. Second, forecasters' projections are most likely to *fail* when a firm needs them most; when there are in fact major shifts and surprises in the market. This is because forecasters often base their plans on assumptions gained from past experience,

and so, by definition, past experience will always be out of synch with any real shift in the market. Third, the bewildering, and for the most part, quite scary thing about a complexifying business world, is that the interconnections found in these markets often buck linear logic: turbulence may give rise to order, stability disorder. In fact, complex markets may have known and codable inputs, but result in outcomes that do not reflect those few original states. Frustrating in the extreme.

The combined result of such contradiction is that *uncertainty* becomes not merely an occasional, deviation from predictability; it is now a basic feature of the business environment. As complex systems not only deliver perpetual novelty, not only bestow constant surprise, they also give rise to the utmost ambiguous situations. And once uncertainty becomes a certitude in commerce, we have no choice but to develop strategies that thrive on such paradoxes. Rosabeth Moss Kanter, the Harvard Business School professor, attempts to catch the tail of uncertainty, in her book *When Giants Learn to Dance*:

To some companies, the contest in which they are now entered seems increasingly more like the croquet game in Alice in Wonderland – a game that compels the player to deal with uncertainty. In that fictional game, nothing remains stable for very long, because everything is alive and changing around the player – all-too-real conditions for many managers. The mallet Alice uses is a flamingo, which tends to lift its head and face in another direction just a Alice tries to hit the ball. The ball, in turn, is a hedgehog, another creature with a mind of its own. Instead of lying there waiting for Alice to hit it, the hedgehog unrolls, gets up, moves to another part of the court, and sits down again. The wicket are card soldiers, ordered around by the Queen of Hearts, who changes the structure of the game seemingly at whim by barking out an order to the wickets to reposition themselves around the court... Substitute technology for the flamingo, employees or customers for the hedgehog, and everyone from government regulators to corporate raiders for the Queen of Hearts, and the analogy fits the experience of a growing number of companies.

The list of anecdotes I have gleaned working with senior management teams, attempting in vain to circumvent uncertainty, would fill this book twice over. They employ the best graduates, engage the top strategy consultants, engaging in the most detailed advanced scenario planning methodologies. But whether you believe that such commitment and strategic soothsaying works effectively or otherwise, is not my point here. My point is, a company that is set up for learning and adaptation, that is geared up for

shock, surprise and non-stop novelty, can thrive on the certainty of uncertainty, without even a hint of what is going to happen next.

Yet a common business response is to restrain uncertainty: tie the croquet game to a strict set of operating rules and regulation, bringing the game into tight and uniform order, where projection and outcome are fixed and sure. After all, it would be a peaceful life if this were possible. Tomorrow's croquet game would look pretty much like yesterday's. But what a meaningless, and even more nonsensical game it would be without uncertainty. Because it is the very uncertainty that paradoxically gives meaningful order and real sense in this world. Uncertainty brings with it intrigue, dynamism, new challenge, the spur of creativity. Uncertainty is disequilibrium, which is, in fact, innovation's vista, it is wild new territory. Thus the only reliable assurance any business has is *leverage on the certainty of uncertainty*.

Clearly, no business can see beyond the looking glass, because the reflection beyond does not exist yet, it has not yet been concocted or found. And the only way to view the future is to walk through the looking glass, explore and invent a new croquet game as and when the uncertainties unfold... Here are three key strategies to scheme when the business world embodies unbroken *terra incognita*:

- *Accept uncertainty.* The more accurate and detailed a prediction of the future is, the more it is merely outlining actuality. All future reality is uncertain, so you have no choice but to make uncertainty an ally. Live off uncertainty, walk in uncertainty, but leverage its properties, its openness to new ideas and concepts. And the first step on the road to leveraging on the certainty of uncertainty is to accept it as a fact of innovation's life.
- *The greater the novelty, the more uncertainty grows.* Too much uncertainty, and risks begins to compound, and eventually overwhelm. Too little uncertainty, and an enterprise will not be doing much innovation, and eventually heads towards equilibrium. A key skill to innovation is to manage uncertainty at the level where an organisation can thrive. A secret here is to take on the right number of innovation projects, with the right balance of novelty and complexity. The project methods in Chapter 18 explain how to do this.
- *Even though we are conditioned to think in serial terms,* and even though we organise in linear ways, at the end of the day, all innovation results from a nonlinear acausal process, continuously leading in unexplored domains and outcomes. And by definition, these unexplored outcomes are unfamiliar, and therefore it is impossible to predict their

behaviour either in the lab or in the market before output. After all, if we understood an invention, it would be familiar, and if it is familiar, again by definition, it is not an innovation. So, it is difficult to understand the true nature of any given innovation until will have experienced the trials and tribulations in the real world. Luckily, this enigma can be broken. What drives uncertainly out is learning, and what accelerates learning is experimentation and prototyping to the breaking point in the real world. We shall be exploring advanced strategies and methods for designing rapid experiments and prototyping in Chapter 3.

If a firm can learn to thrive on uncertainty, that firm will be around for a long time to come. Its market value will be sustained, its people self-assured, and its business platforms always fresh. Therefore, thriving on the *certainty of uncertainty* is now a strategic necessity to prosper in such paradoxical times.

Focus beyond Cause

At 2 a.m. on 16 October 1987, black storm clouds and rushing gales gathered about 100 miles off the south coast of England. Almost immediately they began their approach. When they arrived, all of an hour later, they hit with devastating impact, felling trees as if they were matchsticks, flipping cars as if they were toys. It was the most grievous of storms. A kind that England had not endured for at least 200 years. But it is not solely the force of the storm that is noteworthy, but the way it appeared. The Met Office, even with their billion-dollar technological compound eyeball, had no way of knowing it was on the way. In less than half a dozen hours, a dramatic change in local weather conditions, on a scale not recorded before, began to unravel. The chain of causality that led to the storm moved so abruptly, that it was already too late to prepare for by the time the tempest had begun its approach.

This vivid anecdote begins to tell of yet another great facet of complex systems: that small initial events can swell up so fast, into something so vast, that any attempt to determine the causal chain that leads to an outcome, is totally impracticable. As a system grows to a critical point of complexity, the integrity between ordinary cause and effect shatters. Not because the chain of causality disappears, but because by the time we have tracked down all such correlations, the system itself would have moved on.

Attempting to project into the future with any accuracy, or attempting to plan for tomorrow in detail, or merely speculating on what might come

next just for fun, becomes increasingly difficult, if not impossible. In an intertwined world, familiar reason and outcome begin to break down. In this world, projects are late, journeys are delayed, ambitions are foiled, predictions are illusive, all due to unforeseeable perturbations starting chain reactions elsewhere and remote in the system. Jim Taylor and Watts Wacker express this in their book *The 500 Year Delta*:

In a truly reasonable world, you could plan your way to a reasonable end. Cause would be discernible, effect would be predictable. There would be rewards for rules followed, for loyalty given. Social organisation would hold. Economic and political decision would be binding over the long haul, because the ends they were meant to achieve were discernible at their birth. In a truly reasonable world, the concept of a single career pursued over a lifetime would still make sense. That it doesn't – virtually every young person coming out of college today at least senses the need to be prepared to pursue multiple careers in multiple fields – tells us a great deal about how the world is, not as nostalgia wants it to be... Just as cause has come unhinged from effect, experience has come unhinged from outcome. If you are going to succeed in chaos, you must connect with chaos. You must act in concert with chaos. What does that mean? It means you must trust in intuition, trust in self. One of the beauties of the age now forming is that, finally, you will have to make choices on purely arbitrary bases – because they feel right. It is the ultimate democratisation of logic.

The comprehension required to grasp all of the variables that make up a market system of possible outcomes, is too vast and too fast for any single brain to capture in one hit. The number of facts are so many, and the interval amid cause and effect is so tiny, that detailed explanations become irrelevant. And if an enterprise cannot grasp any explanation, with any reliability, how can that firm plan for any reasonable future? The answers:

- *Focus on a single key variable.* As we shall thoroughly explore, you cannot control or optimise each and every variable within a market system, it is far too complex. However, if you can grab hold of any one agent within a system, and direct it in all its proportions, you will have collateral control over the complete system, because all agents will indirectly adapt to that controlled variable (vis-à-vis virtual chameleons). And what are the key agents in any complex market system? *Customers!* By focusing all your innovation efforts on learning and adaptation to the demands (expressed, emerging, unexpressed) of the customer, you will begin to lead all those zillions of variables throughout the market system. We will expand much on this throughout this text.

- *Focus on end-results.* The further one looks into the future, the more it deviates from the present. Hence the only reliable way to understand any given situation is to act in concert with it. As with surprises, you need to learn and adapt new ideas as and when the changes occur. To do this, takes a different mindset. A thought mode that is indifferent to cause and effect, but concerned with outcome and results in real time. All of this means shifting your focus away from lines of causality towards the far end points of outcome. In fact, a quest for ultra-planned innovations is a delusive way to think and learn, because it assumes the application of linear logic in a nonlinear, paradoxical world. When causal relationships are obscured or unforeseen, the intended innovation seldom pans out as expected. Thus, do not plan in the traditional mode, do not plot projects and schemes in fine detail, but focus on end-result. What, at the end of the day, is it that you want in your hand? Part 5 outlines tools and techniques here.

No one knows when the next market storm will hit, the variables are too many and too fleeting to comprehend. So focus beyond the multiplicity of cause and effects, and on to the end-results that you desire. Even with such complexity, a firm can lead and exploit a hurricane to advantage, if it is certain about where to go.

Leap Discontinuity's Break

Greater interconnected innovations deliver not only unexpected storms, faster, but impart immense structural shifts that compromise the current standard. Because of this, we find ourselves suddenly surrounded with new and often strange concepts, schemes, rules, even laws that all but confuse. In turn, what we know best, or are best at, is quickly overtaken by some unexpected novelty. What we have honed to perfection is soon superseded by some other unfamiliar scheme. In short: cumulative learning and knowledge are lost to discontinuous innovation. Rowan Gibson, a business consultant who has a finger on the beat of complexity, begins to thread together the dynamics of discontinuity in his anthology *Rethinking the Future*:

For a long time we have known deep down that the future will be different from the past. Every science fiction writer, from Jules Verne to William Gibson, has reminded us of that. But what we have stubbornly refused to believe is that the future will be different than we expect it to be. Most of us

still behave as if the future will be a linear extrapolation from the present, like a long straight road that stretches into the horizon... Where A leads to B leads to C lead to D. Chaos theory tells us that the opposite is true. As Michael Crichton writes in *Jurassic Park*: 'Chaos theory teaches us that straight linearity, which we have come to take for granted in everything from physics to fiction, simply does not exist. Linearity is an artificial way of viewing the world. Real life isn't a series of events occurring one after another like beads strung on a necklace. Life is actually a series of encounters in which one event may change those that follow in wholly unpredictable, even devastating ways.' As our world becomes more complex and interdependent, change becomes increasingly non-linear, discontinuous and unpredictable. Therefore the future becomes less like the past. And less like we expected it to be. We find that A might lead to E, then on to K and suddenly Z!... The fact is that the future will not be a continuation of the past. It will be a series of *discontinuities*. And only by accepting these discontinuities and doing something about them will we stand any chance of success and survival in the 21st century. The exciting thing about discontinuity is that it breeds opportunity. It means that nobody owns the 21st century. But in order to grab hold of the future we have to let go of the past. We have to challenge and, in many cases, unlearn the old models, old paradigms, old rules, the old strategies, the old assumptions, the old recipes.

An interconnecting world brings with it a greater number of new possibilities, demanding entirely different ways and means, frequently seeing that old modes die off more rapidly – sometimes catastrophically. Once stable lines of decision and ascension crumble to radically new questions, organisations, concepts, models and orders, that is in economics, markets, technology, education and society as well. What worked yesterday, does not work today, and is all but harmful tomorrow. Tomorrow's innovations from public services to exotic technology will be unlike anything we have known in the past. Thus what we have hard learned and invested in, turns sour sooner than we think.

The message: *all* markets, sooner rather than later, completely disintegrate. Sooner or later an innovation, whether technological, process or conceptual, obliterates established market economics. The television (again), the kind we have known for two or three generations, has been transformed out of recognition, and these radical innovations will in short span be superseded by some other bright scheme. Emerging thin-film display technology, for example, means that TVs will one day soon be printed on T-shirts, at discount prices. Sony, Philips and Mitsubishi better take heed: all markets sooner rather than later completely disintegrate. Sooner or later an innovation, whether technological, process or conceptual, obliterates established

market economics, whether auto-engines, travel services, fast food, gas turbines, anything you care to imagine. And yes, your markets too.

A foreboding paradox of this kind of discontinuity, is that it seems to happen in proportion to the confidence that it will not actually happen! *That is, when an enterprise is sure that a discontinuity will not happen in its markets, it is in fact quite likely to occur.* For example, what could be more secure than the faithful electric-lamp industry, a \$100 billion global market?

Looking back once again: in 1880, gas-lamp technology manufacturers held the market as their own, and so slumbered in near *equilibrium*. But when Victorian entrepreneurs came up with the *novel* and *surprising* idea of electric-lamp technology, the gas-lighting firms sprang to life. Only, what did they do? They went to work – yes – on *optimising* the gas-lamp technologies. And boy, did they come up with some efficient contraptions. At first, the optimisation strategy paid off, many of the electric start-ups went bust. But it was not long before the likes of Thomas Edison made the necessary technological breakthroughs, when the cost of electric-lamp technology dropped significantly. One by one, the gas-lamp manufacturers disappeared.

Now, casting our headlights forward once again. At the beginning of the 21st century, the electric-lamp manufacturers still fare well and hold a panoply on lighting markets. And now, as so-called nanocrystal optics (NCO) entrepreneurs enter the fray, the electric-light manufacturers spark to life, making lamp technology ever more efficient. Even so, NCO may eventually exceed all this clever stuff. NCO may still only be at the embryonic stage, a mere pinprick in the order of things. It is expensive, unreliable, and a one millimetre-square area only pumps out just enough light to see with the naked eye in the dark. But the breakthrough has happened, and the discontinuity will, some time soon, shift in a huge and unpredictable way. Conventional electric-lamp technology, just like the gas-lamp technology of 1880, is on its last legs. Your ceilings, walls, signs, roads, wherever there is an application, may one day soon, emit bright light.

Jim Utterback, the Harvard Professor of Innovation, who studies the discontinuities of innovation, has some deeper concerns here. The overwhelming fact, that even with shock-waving news, such as a new kind of power source, or radically new high performance material, or new management process, most incumbents ignore such novelties. As I have outlined above, optimisation and equilibrium still dominate the management agenda. From Utterback's book *Mastering the Dynamics of Innovation*:

A pattern emphasised in this study is the degree to which powerful competitors not only resist innovative threats, but actually resist all efforts to understand them, preferring to further entrench their positions in the older products. This results in

a surge of productivity and performance that may take the old technology to unheard-of heights. But in most cases, this is a sign of impending death.

So a message to my friends in lighting land (and all industries for that matter), do not simply polish your best lantern technologies, and wait for a new genie to appear; dive into NCO paint, on ceilings, on walls, on roadways, on shopfronts, on – well you name it? Because whatever technology or process or market gave you triumph in the past, can devastate your chances of success in the future... So strategically, what does this mean?

- *Swim across current.* This is the most difficult of all challenges here. How often do we get caught up in the current of rhetoric and dogma of the market? Look at the internet boom (and mobile phones, personal computers, automobiles, retail banking, and so on), it was going to go on and on for ever, wasn't it? But venture capitalists forgot one of the key principles of complex networks, that established domains tend to disintegrate suddenly, and then are replaced with novel patterns of connections. And all markets now suffer this impasse. Whether telecoms, banking, foods or lighting, we all have to live within increasing interconnections, thus discontinuities. So, when the current of excitement, opinions, investments, media news, even the hard market data you have gathered, is in flowing in one direction, your business must have at least 25 per cent of its mass swimming in several different streams. If not, discontinuities will overwhelm.
- *Perfection is dead, long live perfection!* Sustainable value now comes from exploiting a discontinuous stream of the unknown, not smooth optimisation of the well-known. Of all commercial organisations that have ever existed, '99.99' per cent are now part of the business fossil record. The reason? As their inventions became successful, they all, in earnest, attempted to *perfect* their contraptions further. But as they tirelessly honed and improved, they eventually became world-class experts in dead-end knowledge and technology (re: oil lamps, gas lamps, and one day soon electric lamps). But this does not mean that a new breed of technology should not be robust or reliable. Of course, to compete today, an innovation must be rugged under use and abuse. What *perfection is dead, long live perfection* actually means, is a move towards a strategy of discontinuous experiments, learning and innovation, that creates multiple streams of value, while using the appropriate methodologies to make these new discoveries robust and reliable. This we will expand upon in Chapter 3.

- *Unlearning*. There can be no true competence in discontinuous innovation if there is no expertise in destruction of current ways. In fact, trying to forget and letting go of old ways is often harder than learning new ways. Learning is a key proponent of innovation, but little has been said about *unlearning*. It is difficult to break out of old context for a mix of reasons. First, it is quite natural to become attached to current work, whether it be a product or craft. Second, mediocrity is all too often tolerated, it creeps under the skin without notice. Third, managers tend to limit risk taking as a business matures. Fourth, firms value optimisation, over innovation (above). But the most significant reason why firms cling to old ways, is that they forget to forget! That unlearning is not even on the agenda. Here are some ideas for unlearning: Give up equipment (including capital-intensive kit) more than five years old to local schools and colleges (they will love you for it). Continually develop the roles of everybody in the company to (a) a wider context, (b) ones that pre-empt novelties in the market. Bend over backwards to support people in the strive to be different. Praise risk taking, especially when someone trips up. Lastly, log unlearning on the agenda. Paradoxically, you have to learn how to unlearn.

In the bold words of Gary Hamel and C.K. Prahalad: ‘To be a challenger once is enough to challenge the orthodoxies of the incumbents; to be a challenger twice, a firm must be capable challenging its own orthodoxies’. And that means tireless provocation of the discoveries you find, and the new ventures in which you partake. Only then will you learn to let go and leap discontinuity’s break.

Thriving on Paradox

It is a different world, is it not? The mild and comfortable divisions of yesteryear are gone. The interconnections are here, and growing at a rate faster than any can count. As markets and technology mimic the network-like structure of complexity, we will only become increasingly exposed to the paradoxical behaviours of perpetual novelty, constant surprise, acausality, uncertainty and discontinuity. Therefore, there is little room but to adopt the strategies and mindsets that thrive on such paradoxes. Accordingly, the rest of this book embeds and expands upon the stratagem outlined above. In particular, each is complemented with the multidimensional thinking modes described in the following chapter.

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