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The Enterprise as a Living System

This chapter is about the need to liberate the enterprise from the grip of the mechanistic model and the criticality of treating a business as a living system. The chapter also covers the key characteristics of living systems and their implications for a company.

For decades, enterprises have been modeled as closed-ended systems, the rationale for which is discussed in this chapter. Closed-ended systems, for example, machines, are largely insulated from the external environment and incapable of learning on their own. Hence, although they are highly predictable and stable, systems are not capable of sensing, responding, and adapting to changes in the environment. Open-ended systems, also known as living systems, on the other hand, interact with the environment through the exchange of information, learn from interactions with the environment and, therefore, are able to evolve by adapting and responding to change, for example, humans have evolved from apes.

It can be concluded that organizations modeled as close-ended systems find it extremely difficult to evolve with a changing environment. For an enterprise to sense, respond, and adapt to change, it needs to be transformed to become an open-ended or living system.

The chapter will explore the following topics:

- The mechanistic approach, which is outdated for enterprise modeling
- The widening sustainability gap for businesses
- Need to reinfuse "life" into enterprises

- Complex adaptive systems (CAS) – a proven model of high agility
- Reasons for high agility in CAS
- Implications of CAS for organizations

The mechanistic approach that is outdated for enterprise modeling

Looking back in history, the period from 1945-71, also known as the Golden Age of Capitalism [i], saw an unprecedented boom in business activity. The only major problem that businesses appeared to have in this period was how to produce more, to satisfy the ever-increasing demand for their products and services. Most enterprises had limited product and service offerings and custom-made offerings were an exception. Companies during this period were production- or inward-focused. Competition was not very intense and the business environment was largely stable and predictable, compared to today.

The focus of companies was largely on standardization and maximizing efficiency. Processes and tools were, by far, more important than people. People were mandated to adhere to processes and comply with "orders" from "bosses." Innovation and creativity were limited to research and development departments, if considered at all.

In this period, enterprises were modeled on mechanistic systems that were appropriate for manufacturing activity. According to *The Law Dictionary*:

> *"This type of organization is hierarchical and bureaucratic. It is characterized by its (1) highly centralized authority, (2) formalized procedures and practices, and (3) specialized functions. Mechanistic organizations are relatively easier and simpler to organize, but rapid change is very challenging." [ii]*

This model works on the premise of control, that is, it implies that companies, like machines, can be designed to behave exactly as expected and every part of the enterprise will execute its functions in a repetitive and predictable way, without any variability. The business is expected to change its behavior only when there is deliberate intervention. The model follows the idea that the natural evolution of a mechanistic system only means wear and tear or obsolescence. Like machines, mechanistic organizations have no life and, therefore, little or no agility.

However, the most critical element of any enterprise is its people and unlike machines, people have feelings and aspirations, are curious and, being naturally social in nature, like to engage with other people. Employees get bored doing repetitive work. Machines do not. Machines, by definition, cannot be creative. People, by definition, are creative. People-centricity is the essence of agility and the mechanistic model hinders enterprises from becoming people-centric.

Taylor's scientific management theory – the roots of mechanistic modeling

It is important to understand the roots of mechanistic modeling so that its limitations can be addressed in the most effective manner. The roots of mechanistic modeling for businesses lie in Frederick Taylor's *Theory of Scientific Management* [iii]. Taylor's theory revolutionized the way that enterprises were run. It helped businesses to maximize efficiencies and to scale operations quickly. The theory helped companies to master the craft of manufacturing, which is about designing an object upfront and producing that object repetitively to exact specifications. Prior to this theory being adopted, there was no known systematic way of running a business, especially related to manufacturing. Taylor's theory points toward the following three key beliefs.

Managers should "think" and workers should "do"

This implies that the "doers" should "put blinkers on" and do exactly as they are told. Whatever information they gather from the environment, they are expected to pass it on to their managers, who are deemed more capable of making decisions.

Efficiency is the most important outcome to aim for

This implies that the work being done is repetitive in nature, thereby making it possible to apply scientific methods to improve productivity. The statement also implies that the doer should optimize their part of the work, without worrying about the overall outcome.

Processes and methods should drive ways of working

This implies that standardization is important, and not creativity, that most work-related circumstances and instances can be predicted in advance, and will have minimum variations or exceptions, and that people should not apply their own mind. Most importantly, the statement suggests that people are easily replicable like cogs in a wheel, and processes and methods are robust enough to smooth out the disruptions arising from people churn.

These beliefs, especially the "thinker versus doer" separation, are the primary reason for an organization to become mechanistic in nature, and thereby the people within the firm become mechanistic "resources" as well. While Taylor's theory was revolutionary in helping businesses to scale their activities, it is a huge impediment to enterprise agility in the following ways:

- The "thinkers," that is, the leaders and middle managers are removed from the customers, as they are largely kept busy preparing reports and plans and attending endless internal meetings.
- The "doers" have very little or no autonomy to make any decision that might please the customer. They are expected to follow the standard operating procedure and have to seek approval for deviations. Sometimes, the deviation has to traverse multiple levels up in the hierarchy for the decision to be made.
- It forces people to organize activities around specializations, rather than around outcomes and the delivery of value, which is almost always not optimal from the perspective of the customer and therefore for the enterprise as well.
- By the time the information has traversed the hierarchy and has reached the manager, it usually has become diluted and also outdated. Decisions made on information which may not reflect the context at that moment are likely to be suboptimal, especially considering that the manager may have very little information about the ground-level realities.
- The "doers" do not get a voice in defining and shaping strategy, which leads to them not feeling engaged with their work. There is no incentive for people to be passionate about their work, which severely limits excellence. Customers will likely feel the indifference of the "doers."

- If the number of managers becomes large, then more managers are needed to manage these managers, thereby adding more unproductive layers to the hierarchy of managers. The value these additional layers in hierarchy bring to the enterprise is highly questionable, as the managers in these middle layers are mere channels to pass information between the hierarchy layers.
- The extreme importance given to compliance and adherence to processes leaves no incentive to innovate.

Does this imply that we should simply abandon the scientific management theory? Of course not. It would be akin to "throwing the baby out with the bath water." Even living systems have some parts which work mechanically and which need to be treated as such, for example, in a human body, the heart works like a machine. Moreover, focus on optimizing efficiency will always remain a critical element of profitability for a company, for example, a global online retailer's fulfilment centers across the globe are run on principles of Taylorism, due to the repetitive nature of the work, so the teams in the offices are set up for enabling knowledge work and creativity.

What is needed is recognition that enterprises need to "live and breathe" in order to evolve with and adapt to change, and that continuing with the mechanistic model in its purest form, just because it has been widely successful in the past, is likely to severely impair agility. Companies need to examine which aspects of this model have become outdated and therefore the impediments to agility in their specific context and address those impediments in order to infuse life into the business. Peter Drucker, considered to be the father of modern management, predicted the rise of knowledge work, which takes place in people's brains, as opposed to mechanistic work, which is primarily performed by machines. This has major implications as the primary resource used by businesses shifts from tangible assets such as land and labor to an intangible asset: knowledge.

In an article in the Harvard Business Review, Rick Wartzman, author of the book, *Drucker: A Life in Pictures*, states:

> *"Drucker had been anticipating this monumental leap – to an age when people would generate value with their minds more than with their muscle – since at least 1959, when in Landmarks of Tomorrow he first described the rise of knowledge work. Three decades later, Drucker had become convinced that knowledge was a more crucial economic resource than land, labor, or financial assets." [iv]*

Businesses have always evolved and will continue to evolve in order to adapt to the changing environment. Some enterprises, such as Toyota, despite being a purely manufacturing-oriented business, began recognizing the importance of people much earlier than many organizations of that scale and size. This importance is reflected in *The Toyota Way* [v], which has several principles that are people-centric. However, the issue is that the mechanistic model is so deeply embedded in many enterprises that they are finding it difficult to evolve at the speed at which the external environment is changing. This is creating a sustainability gap for companies, which is getting wider with the onset of the digital age. Businesses looking at a wide sustainability gap face a threat to their survivability.

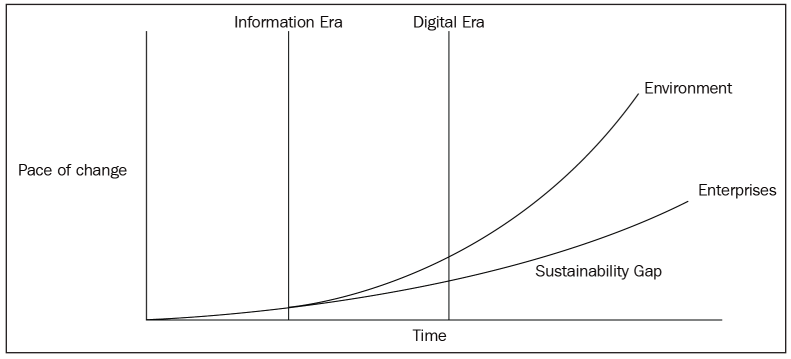

Figure 3.1: The sustainability gap facing enterprises

The preceding diagram depicts the widening off the sustainability gap due to enterprises being unable to keep up with the pace of change of the environment. The gap has been widening at a faster rate, especially after the start of the digital era.

Empirical evidence suggests that companies are finding it difficult to bridge the sustainability gap. According to Wouter Aghina, a partner at McKinsey & Co.:

"When machine organizations have tried to engage with the new environment, it has not worked out well for many. A very small number of companies have thrived over time; fewer than 10 percent of the non-financial S&P 500 companies in 1983 remained in the S&P 500 in 2013. From what we have observed, machine organizations also experience constant internal churn. According to our research with 1,900 executives, they are adapting their strategy (and their organizational structure) with greater frequency than in the past. Eighty-two percent of them went through a redesign in the last three years. However, most of these redesign efforts fail — only 23 percent were implemented successfully."

The only possible way that enterprises can bridge this gap is through enhanced agility, which will enable them to keep up with or even exceed the pace of change of the environment.

Need to reinfuse "life" into enterprises

A fast-changing environment necessitates that businesses have agility, that is, they should be organic like living systems and not lifeless like machines.

According to Michelle Holiday, president of Cambium Consulting:

> *"This new story is emerging all around us, though few have connected the dots. Why does a flat, networked organization now seem the better choice, when we've relied on rigid hierarchy for so long? Why do we need to engage the passion of people within, when for so long we've considered them simply 'labor'? Why do we need to engage customers in meaningful conversation, when for so long it was enough to deliver a quality product? The answer is that each of these is a move in the direction of resilience, adaptability and creativity. In other words, it's a move in the direction of life." [vi]*

A timeless fact about businesses is that they have always had people. Of course, while machines may be more significant in some companies than others, depending on the nature of the industry they are in, the indisputable fact is that people have been and still are an enterprise's most valuable asset. This can be easily corroborated by examining the extent of people-centric agility that a business has at the startup stage. Most businesses lose agility as they grow in scale, as the mechanistic model gets applied after the enterprise grows beyond a certain size. Exceptions to this are companies such as Google and Apple, which appear to maintain their agility despite continuing to grow in size. Given that the mechanistic modeling of companies is stifling agility, it is necessary to free the enterprise from the clutches of this largely obsolete model and bring the business back to life.

Complex adaptive systems (CAS) – a proven model of high agility

The challenges of environments becoming highly dynamic, interconnected, and unpredictable might be new in the context of business, but they are widely prevalent in life and social sciences and have existed since eternity. Prominent examples are humans, ecology, the global macroeconomic network within a country, or group of countries, the stock market and complex webs of cross-border holding companies, social insect (for example, ant) colonies, and any human social group-based endeavor. These systems are better known as **complex adaptive systems** (**CAS**). These systems have demonstrated a pattern of evolving, that is, adapting and responding to change.

According to Martin Reeves, co-author of *Your Strategy Needs a Strategy*, and others in an article in the *Harvard Business Review*:

> *"We stress that companies are identical to biological species in an important respect: both are what's known as complex adaptive systems. Therefore, the principles that confer robustness in these systems, whether natural or manmade, are directly applicable to business." [vii]*

Given how consistently and effectively these systems have demonstrated agility, it is worth exploring whether there are any learnings from CAS for enterprises, with respect to dealing with change.

What are CAS?

According to BusinessDictionary.com, CAS is defined as:

> *"Entity consisting of many diverse and autonomous components or parts (called agents) which are interrelated, interdependent, linked through many (dense) interconnections, and behave as a unified whole in learning from experience and in adjusting (not just reacting) to changes in the environment." [viii]*

One of the most popular definitions of CAS was offered by John H. Holland, a pioneer in the study of CAS:

"A Complex Adaptive System (CAS) is a dynamic network of many agents (which may represent cells, species, individuals, firms, nations) acting in parallel, constantly acting and reacting to what the other agents are doing. The control of a CAS tends to be highly dispersed and decentralized. If there is to be any coherent behavior in the system, it has to arise from competition and cooperation among the agents themselves. The overall behavior of the system is the result of a huge number of decisions made every moment by many individual agents." [ix]

According to Wikipedia:

Complex adaptive systems are complex in that they are dynamic networks of interactions, and their relationships are not aggregations of the individual static entities, that is, the behavior of the ensemble is not predicted by the behavior of the components. They are adaptive in that the individual and collective behavior mutate and self-organize corresponding to the change-initiating micro-event or collection of events.[x]

The following diagram is a pictorial model of a CAS [xi]:

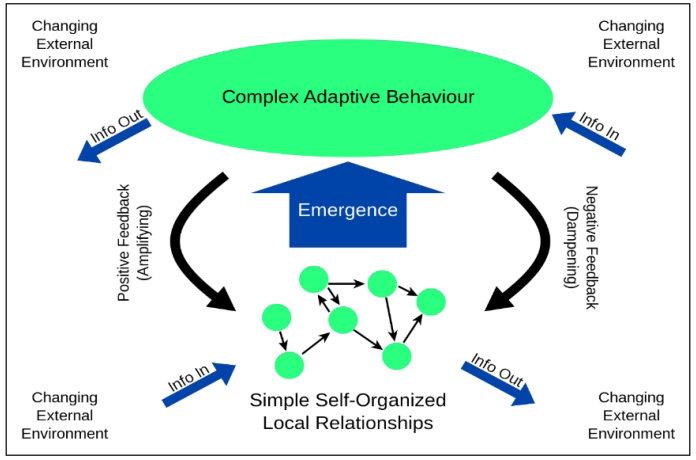

Figure 3.2: CAS operating model

The preceding diagram depicts the operating model of CAS, at a high level. Self-organizing agents interact with each other, which creates complex adaptive behavior through emergence. The agents receive both positive and negative feedback on their behaviors, which helps them to adjust their behaviors. Moreover, the agents and their behaviors influence and also get influenced by the external environment.

Characteristics of a CAS

We will now look at the key characteristics of a CAS and their implications for enterprises with respect to moving the companies away from the mechanistic model and bringing "life" back into them.

Continuous evolution

The most important characteristic of a CAS is that it evolves continuously. Let's take human beings as an example. We, as a CAS, have evolved over millions of years from apes to our current form. We have shed the tail, as it was of no use to us. We branched into multiple races. We are still evolving and will continue to do so. Another example is economies, which were long ago based on a barter system and then went on to paper and credit money and now seem to be moving toward cryptocurrencies. The evolution of a CAS keeps pace with the changes in the environment. This is the primary reason for the resilience in a CAS, which significantly improves its chances of survivability.

Autonomous and self-organizing agents

A CAS comprises of agents that interact with the environment and with each other and adapt and respond based on feedback. In an economy, the agents might be individuals or households. In an ecosystem, the agents are species. In a brain, the agents are nerve cells. Agents can be non-living entities like banks in financial markets, political parties in a democracy, and so on.

As depicted in the pictorial model of a CAS, there is constant action and reaction to what is happening in the environment and to what other agents are doing, thus making the system constantly dynamic. Agents may be able to relate to each other through a structure, but the structure changes and evolves based on the need to adapt to context.

There is no single centralized control mechanism that governs the behavior of the agents or the system itself. Agents have the autonomy to behave as they deem fit, subject to boundaries and some restrictions, for example, humans have the freedom to decide when to marry, but will be punished if they threaten someone into marriage.

Although the interrelationships between agents in the system produce coherence, the agents are constantly reorganizing to find the best fit with the environment, for example, a new honey bee queen is created when the number of bees in a hive becomes too many.

Agents' interactions influence system behavior

CAS behavior is driven by the inter-relationships, inter-action, and inter-connectivity of the agents within a system and between a system and its environment. The relationships and interactions between the agents are generally more important than the agents themselves, for example, in a human body, the brain operates quite independently and so does the digestive system. However, the interaction between these subsystems, which are agents themselves, is critical for the optimal functioning of the larger system. The digestive and respiratory system may seem disconnected, but digestion cannot happen unless the respiratory system provides it with oxygen, and the respiratory system cannot function unless the digestive system converts food into energy. Some systems are based entirely on interactions between agents, for example, an economy cannot function unless there are both buyers and sellers for goods and services.

Agents' behavior is driven by purpose

The driver behind agents interacting with the environment and with other agents is always some purpose. For example, the primary purpose behind all living species interacting with the environment is survival. While this interaction is necessary and unavoidable, it may not be so for other purposes, for example, people trade in the stock market to create wealth and people join a social organization like the Rotary Club for multiple purposes, like social service and fellowship. Even people getting together to celebrate a birthday or a wedding is a purpose-driven behavior.

Loosely-coupled agents

The agents in a CAS are loosely coupled. This implies that when some agents are removed or when a part of the system fails, the rest of the system is either not impacted or recovers quickly, for example, if some investors leave the stock market, the market continues to function normally. When a large financial institution like the Lehman Brothers collapses, it might bring down a few other institutions with it and make the economy wobble a bit. However, the economy will eventually recover.

The key to being loosely coupled is flexibility in the structure of the system and the diversity of behavior of the agents. If the agents behave in a coordinated or unidirectional manner, the system's behavior will change to being tightly coupled. A stock market crash leading to panic selling and a run on a bank are examples of tightly coupled behaviors.

Variety is a source of strength

The more variety there is in a CAS, the stronger it is. The diversity in a CAS leads to ambiguity and paradox. However, a CAS uses contradictions and uncertainty to create new possibilities to evolve with and adapt to the environment. This reinforces the idea of bounded instability or the edge of chaos that is characterized by a state of paradox: stability and instability, competition and cooperation, order and disorder. Democracy and financial markets are examples of a CAS where a variety of agents leads to the strength of these systems. In living systems, the importance of genetic diversity has also been widely recognized.

According to The National Gardening Association:

> *"Genetic diversity strengthens a population by increasing the likelihood that at least some individuals will be able to survive major disturbances, and by making the group less susceptible to inherited disorders." [xii]*

Emergent behavior

Complexity in a CAS refers to the potential for emergent behavior in complex and unpredictable phenomena. There is constant action and reaction to what other agents are doing. From the interaction of the individual agents arises some kind of global property or pattern, which is something that could not have been predicted from understanding each particular agent, for example, the overall behavior observed in the economy is a result of the countless decisions made by millions of individual people. Any coherent behavior in a system arises from competition and cooperation among the agents themselves.

A poignant example is that if we were to take all the food shops in a town and divide all the food by the number of people living there, we would find a pattern that there is always one-to-two weeks' worth of food supply in the town. However, this is achieved without a food plan for the town or a formal controlling process.

Another example is of a termite hill that has an amazing architecture, with a maze of interconnecting passages, large caverns, ventilation tunnels, and much more. Yet there is no grand plan, the hill just emerges as a result of the termites following a few simple rules.

The nonlinear relationship between cause and effect

In a CAS, the relationship between cause and effect is not necessarily linear, and sometimes not even correlated. Small changes can have a surprisingly profound impact on overall behavior, or vice versa, a huge upset to the system may not affect it. An example of a nonlinear relationship is how Bearings Bank was brought to closure by the actions of just one person, Nick Leeson. The fluttering of butterflies in Brazil causing tornadoes in the state of Texas in the USA [xiii] is an example of a lack of direct correlation between cause and effect. Hence, the causes of many effects may be found only in hindsight, which then may lead to interpreting them over a period of time as patterns.

There is a fine line between order and chaos. A system in equilibrium does not have the internal dynamics to enable it to respond to its environment and it will slowly (or quickly) die. Too much order implies too many constraints and that stifles innovation and creativity. An automobile is an example of an orderly system, which (usually) behaves in a very predictable manner. A system in chaos ceases to function as a system, until order is restored, for example, a severe traffic jam due to a failed traffic signal at a busy intersection. Hence, the most productive state to be in is at the edge between order and chaos, where there is maximum variety and creativity, leading to new possibilities. CASs function best when they combine order and chaos in an appropriate measure, for example, there are some unwritten rules about traffic in Johannesburg, South Africa [xiv], which have emerged from the city being on the edge of order and chaos.

The key to understanding the word chaos in this context is to understand it not as anarchy, but as a lack of structure. A CAS is ruled by the second law of thermodynamics: it is in a constant state of equilibrium, entropy, or disorder, which will keep increasing such that the system will wind down and eventually die, unless it renews itself.

In a CAS, the rules governing the functioning of the system are quite simple. A classic example is that all the water systems in the world (all the streams, rivers, lakes, oceans, waterfalls, and many more, with their infinite beauty, power, and variety) are governed by the simple principle that water finds its own level. The simplicity in rules enables self-organization, which is the key to the system being on the edge of order and chaos, and effectiveness over efficiency.

A CAS, once it has reached the state of "being good enough," that is, the energy wasted is less than the energy spent on improving itself, will trade off increased efficiency every time in favor of greater effectiveness. A simple example is the human body, which will start burning stored fat in the absence of food.

Patterns of behavior

The collective behavior of the agents leads to the formation of broad patterns, which are far more predictable than the behaviors of an individual or a group of agents. The economy has patterns of recession-recovery-boom-slowdown. The weather has a pattern of seasons. While the patterns are largely predictable, the timing of the onset of a pattern is much less predictable. When the economy is in recession, when the recession will end and when recovery will start cannot be predicted.

Reasons for high agility in a CAS

The analysis of CAS characteristics helps in understanding the key reasons why a CAS has high agility. These are as follows:

- Agents, that is, employees in the context of an enterprise, are empowered to deal with the environment and interact with other agents, in a manner which they deem as best for the situation at hand
- Agents learn based on feedback and change themselves and adjust their behaviors accordingly
- Agents are actively and purposefully engaged with the system
- Agents and the system discard what is not working, and constantly evolve to find the best fit with the environment
- CAS purpose, structure, and processes are dynamic and evolve based on emergent information

Implications for enterprises

The characteristics of a CAS provide meaningful pointers for reinfusing life into companies. The following table is a summary of the implications for businesses, which are derived from the characteristics of a CAS:

CAS characteristic	Implication for enterprises
Continuous evolution	Enhanced agility
Autonomous and self-organizing agents	Responsive structure
Agents' interactions influence system behavior	Build social density Amplify success stories Encourage healthy friction
Agents' behavior is driven by purpose	Link purpose to work
Loosely-coupled agents	Balance proximity and modularity
Variety is a source of strength	Cultivate diversity
Emergent behavior	Build on emergence
Nonlinear relationship between cause and effect	Shorter feedback loops Experiment with lever points
The fine line between order and chaos	Balance order and chaos Selective destruction Simple rules Safe to fail experiments
Effectiveness over efficiency	Prioritize effectiveness over efficiency
Patterns of behavior	Monitor and leverage patterns

The explanations of the implications are as follows:

Enhanced agility

The overarching implication is that enterprises will need to be attuned to the changes in the environment, and reform and reinvent themselves accordingly. The critical point is the pace of adaptation, as that needs to keep up with the blistering pace of change, that is, change as fast as change itself. To do this, businesses will need high maturity in all the capabilities that are underlying agility: responsiveness, versatility, flexibility, resilience, innovativeness and, of course, adaptability.

Responsive structure

The enterprise needs to have a structure that supports autonomous, decentralized, and outcome-oriented teams, which will facilitate interoperability and information sharing among people. This structure should have a wider periphery, which facilitates closer interaction with the environment and therefore enables the company to be more responsive.

According to Niels Pflaeging, author of *Organize for Complexity*:

> *"It is the periphery that learns from the market easiest. That can best adapt to and respond to markets — quickly and intelligently. In complexity, the center loses its information monopoly, its competence advantage: it can hardly issue any meaningful commands anymore. The coupling between periphery and center must consequently be designed in a way that enables the organization to absorb and process market dynamics. For that, the periphery must steer the center through market-like mechanisms and own the monetary resources". [xv]*

This aspect is discussed at length in *Chapter 6*, *Structure.*

Build social density

Social density is the number of interactions that are likely to happen between agents within a given space. Enterprises should put enablers in place to encourage social density between people, giving special attention to social density between the people whose interactions are more critical for the business.

Attention given to ensuring adequate social density is particularly important when change is recently introduced and agents are still getting used to being in a common space, which they did not share before the change, for example, DevOps bringing together the development and operations teams, which prior to the change had a "wall" between them. A concrete measure to increase social density for these agents can be to include operations in project inception and release meetings, thereby engaging them right from the beginning of the delivery cycle.

In case the social density appears to be low, the underlying cause needs to be fixed, for example, if team members are always overloaded with work, and are frequently multitasking, the conditions are not right for them to have meaningful interactions. **Communities of Practices** (**CoPs**) are a highly effective way of enabling social density. The Spotify model [xvi] (Squads, Tribes, and so on) is a popular model for establishing CoPs.

Amplify success stories

Stories too are agents, albeit logical and in an enterprise, and hence success stories should be identified and socialized across the company. The more the desire for other agents to connect to the success story, or to create another one, the higher the chances of coherence around the desired outcomes.

Encourage healthy friction

Healthy friction among agents is one of the key reasons for higher resilience in a CAS. While at the agent level the objectives might appear contrary, at the system level it is important to align the agent-level objectives to the broader objective of the enterprise. Marketing may want to increase spend on advertising, but finance may be keen to control costs. Both are valid objectives at the respective agent levels and may appear contrary, but a balance needs to be achieved between them to meet the business' objective of increasing sales. It may be possible that the agents will work out a better way to increase sales with minimal additional spend on advertising. The key is that the agents have autonomy to resolve the conflict in a manner that best meets the broader objectives and they are enabled to do this with integrative thinking skills.

According to Roger Martin, a former dean at Rotman School of Management at the University of Toronto in Canada:

> *"Integrative thinkers aren't satisfied with simply making an unpleasant trade-off. Instead, they master the ability to constructively face the tensions of opposing models, and instead of choosing one at the expense of the other, they generate a creative solution of the tensions in the form of a new model that contains elements of the individual models but is superior to each." [xvii]*

Healthy friction and an integrative thinking approach will enable employees to come up with out-of-the-box solutions to deal effectively with the unique challenges presented by the dynamic environment. The creative solutions that emerge, through employee interaction, can provide a significant boost to agility.

Link purpose to work

The purpose of the enterprise, broken down into vision, mission, strategy, and initiatives, must be socialized across the business such that the agents, namely, people in the enterprise, are able to establish a connection between the work they are doing and the purpose of the company. Staff being aligned with an organization's purpose is a necessary condition to be able to effectively deliver value-driven outcomes. Besides autonomy and mastery, purpose is a key factor in intrinsically motivating people who are knowledge workers. This topic will be discussed in more detail in *Chapter 6*, *Structure* and *Chapter 8*, *Process*.

Balance proximity and modularity

Given the criticality of the interaction between the agents in shaping the outcomes and evolution of the system, it is important to ensure that no agent remains disconnected or connected weakly with the agents they are supposed to interact with. The connectedness should help in improving the flow of information and knowledge between agents. It is critical to remember that agents include external entities like vendors and, of course, the customers.

While connectivity is important, the right level of modularity should also not be overlooked. Modularity helps in achieving coherence, as well as in increasing the ability of the system to absorb shocks better. Modularity may involve reorganization of the agents, which might cause short-term pain but could result in significant long-term benefits, for example, if teams are structured as component teams, then increasing connectivity within the component teams, which are specialized to work on a layer of a feature (for example, the user interface), will surely yield some benefits. However, far greater and more sustainable benefits can be achieved if the teams are restructured as feature teams, that is, teams which work on the entire feature. This topic is discussed in detail in *Chapter 6*, *Structure*.

Cultivate diversity

For decades, businesses had the tendency to resist change. Heavyweight approval processes, change control boards, and so on, were put in place to ensure that only a selected few had the right to decide what changes should be made, if at all. The higher the predictability, the more reassured the leaders were that "everything is under control." There was a defined process for everything, compliance to processes was expected and rewarded, and those committing "deviations" were punished. Standardization, therefore, not only became the means to achieve predictability, but in many cases became the goal itself.

Standardization consequently leads to homogeneity, which is the opposite of diversity. However, biological species are known to become more vulnerable as they become more genetically homogenous. Nature has therefore put in a mechanism of sexual reproduction, which leads to the random matching of chromosome pairings. This results in more permutations and more variety in offspring. According to William Hamilton, an evolutionary theorist from the University of Oxford, "enemies," that is, harmful germs, find it much harder to adapt to a population born through sexual reproduction, as opposed to one born via parthenogenesis.

In the context of an enterprise, people are chromosomes, the genetic material that creates variety and diversity. Therefore, a business must strive for diversity in its people (gender, ethnicity, education, and experience), and, more importantly, encourage diversity of thought. A company must also leverage the fresh perspectives that newly hired talent can provide.

Without internal variety and diversity, a business will find it very difficult to deal with the variety and diversity of today's external environment. Diversity also means having the right balance between process standardization and autonomy for the people closest to the environment to override processes, as needed, if that helps to deliver greater value.

Build on emergence

In a dynamically changing environment, it is futile to try to predict the long-term future state accurately. Hence, rather than working backwards from an imaginary and inaccurate future state, it makes much more sense to work forwards based on the current state, which is known. Complexity implies that the end solution to a problem cannot be predicted at the outset. Moreover, the nature of the problem itself may undergo change, with a change in circumstances and the emergence of new information.

Not defining a future state should not mean lack of clarity about the goals and intended outcomes. However, the means to achieve the goals and outcomes must remain flexible. Hence, instead of having a detailed plan, which is supposed to show the exact way to get to the future state, a rolling plan should be prepared to ensure and maintain alignment with the broader intended goals and outcomes. The plan should be detailed closer to current time, with progressive lower levels of details into the future. It is important to keep this as an organic element and to keep evolving this continuously, based on "today's reality." The plan should emphasize higher predictability in the near term and higher flexibility in the medium and long term.

The following diagram is a visual depiction of a rolling wave plan:

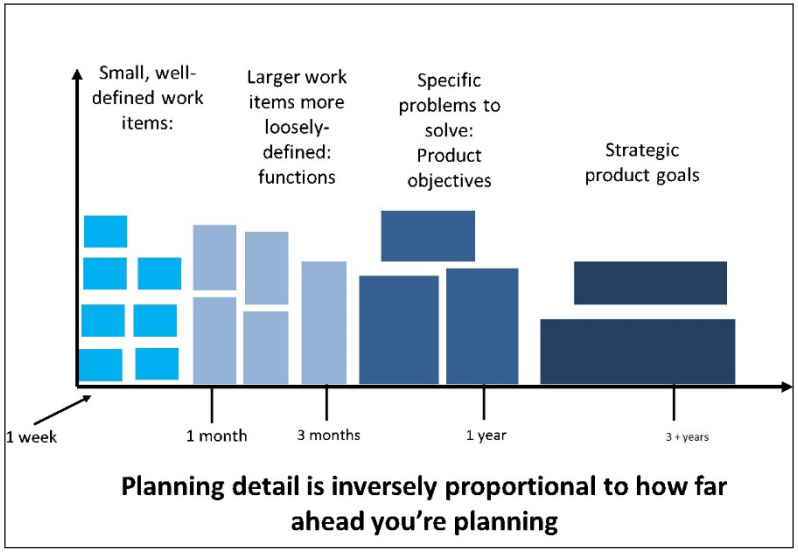

Figure 3.3: Rolling wave plan

In the preceding diagram, strategic product goals are defined for a longer period and the product objectives, functions, and work items are defined at progressive lower granularity, with the lowest granularity defined for work to be done closest to the current time.

The parts of a CAS cohere around common goals and hence the plan should clearly reflect the goals of the enterprise. Agents will self-organize in conducive conditions and do what it takes to achieve the goals. Building on emergence implies that the goals and outcomes may also need to undergo change, based on changes in the external environment. In such a case, the plan needs to change to reflect the revised goals and outcomes, and also the means to achieve the outcomes.

Another critical aspect of emergence is to work with "just enough" information. What is just enough is totally context-specific. However, it should be adequate to conform to an existing pattern or to form a new pattern. Seeing information as patterns is especially important as it is quite easy to get lost in data, which is available in abundance.

Information being valid for investigation and exploration should be the driver to guide the next steps. A practical example is the amount of time to travel from destination *X* to *Y*, by taxi. In terms of planning, it is good enough to know that it takes roughly 20-25 minutes for the journey. Knowing that it took 21 minutes and 33 seconds and 24 minutes and 10 seconds the past two times is valuable, but estimating to the last second for the next journey adds very little value.

Emergence also means that the enterprises have to be ready to deal with unforeseen circumstances, for example, customers venting their anger about a poor product or service on social media and its immediate and widespread negative impact is something which may not have been initially anticipated by companies. However, now that this behavior has become a pattern, businesses have no option but to put in a mechanism to spot such complaints and mitigate them as early as possible.

Shorter feedback loops

As outcomes can be nonlinear and, more importantly, can often result in unintended and unwanted consequences, feedback loops across the enterprise need to be as short as possible. Feedback is much more valuable when it is timely. A simple example is of a software defect. The direct and indirect costs of the defect are much lower if the defect is detected closer to when the code is written, versus if the defect is found when the code is in production.

Feedback loops should be made shorter and stronger at all levels including between team members, between teams, between teams and customers, teams and leadership, team and code, and so on. It is not only important to act appropriately based on feedback but also to learn from it by drawing out patterns based on the received information.

Feedback should be sought actively rather than waiting for the concerned entity to provide the feedback. It is often wrongly assumed that when no feedback is received, everything is fine. This is a truly wrong assumption to make. If we examine our own experiences as customers, how often have we taken the time and effort to provide feedback, whether positive or negative, when it has not been solicited?

It is worth calling out that a CAS is able to deal with change effectively not only due to short feedback loops but also because it is structured in a way which enables the agents to collect and respond to feedback effectively.

Experiment with lever points

Most management theories and practices are based on a deterministic cause and effect principles, for example, incentivize employees with more money and they will deliver more/work harder. However, one of the core properties of a CAS is nonlinear or disproportionate causation, that is, a small action resulting in a disproportionate effect and vice versa. Actions that are inexpensive but lead to significant positive outcomes are called **lever points**. These points can be identified through experimentation or learned based on patterns of empirical evidence.

Agile practices have many such lever points, which enhance agility, for example, putting up a visual board to depict the pipeline of work in a process usually has a highly positive impact in terms of identifying blockers, managing dependencies, and focusing on higher priority items. Another example is a daily stand-up meeting.

Lever points can also be used quite effectively in influencing culture change. A senior leader could participate in a retrospective exercise to learn about why something failed and then encourage the team to learn from that mistake, sending positive signals across the enterprise, especially if the employees of that business are generally afraid of failure. Socializing success stories is another lever point that has usually resulted in broad-based positive outcomes across companies.

Balance order and chaos

In order to deal with change, enterprises, like a CAS, need to undergo change themselves. This change can be in the form of reorganization, selective destruction and renewal, reshaping or something else. As mentioned earlier, a firm cannot be at equilibrium for any meaningful period, as the forces acting upon it are changing constantly. The very basic definition of equilibrium is that "it is a state of an object in which all forces acting upon it are balanced."

Essentially, a CAS will do "whatever it takes" to survive under changing conditions. All CAS appear to follow this pattern. It is only by being in this "sweet spot" that CASs are able to deal most effectively with change.

The implications for enterprises are as follows.

Selective destruction

An example of selective destruction in a CAS is how forest fires have been found to be a crucial factor in regenerating healthy forests. The key takeaway for companies is that destruction is part of evolution. In practical terms, it means getting rid of anything that has become obsolete and is no longer delivering value. In the prism of a fast-changing environment, obsolescence is defined by relevance and not age. Examples include obsolete IT solutions, non performing business units, and at more granular level, a practice or a process followed by a team, which is no longer adding value.

A key point to remember is that intervening to prevent something that needs destruction can prove disastrous. The major fire in Yellowstone Park in the USA, in 1992, is a good example of this. As stated earlier, forest fires are considered healthy for the regeneration of forests. However, forest fires were prevented from happening for decades in Yellowstone Park, through human intervention. Gradually, the forest floor accumulated a very thick layer of debris. Eventually, a lightning strike caused a fire that could not be contained. Decades of accumulated debris burned hotter and longer than normal. This incinerated large trees and destroyed living components of the soil, which would have otherwise survived a normal fire. The fire wiped out 25% of the park.

Enterprises must build a culture where people can challenge anything that may not be adding value now. It is fairly common to see people doing things because "we have always done it that way." Going further, teams also need to be empowered to stop or modify what no longer adds value, be it a process, practice, role, communication pattern, and so on.

Selective destruction also needs to be viewed from the point of view of "destroying" something where a better alternative has emerged, for example, the possibility of hosting IT infrastructure in the "cloud" can lead to getting rid of a physical IT infrastructure, as the former may be both more effective and efficient. Selective destruction, when appropriate, will not only enable a business to remain lean, but it is also a huge enabler for a company to keep evolving in line with the changes in the environment.

Simple rules

As stated earlier, all CASs operate on simple and minimal rules. For an enterprise, this means setting appropriate boundaries and keeping the rules simple and minimal. It also means letting the people, and networks of people, interact among themselves and with the environment to organize through an iterative process of creative exploration and selective destruction. Agility is most effective when the people who are closest to the environment have the space and freedom to interact with the environment as they deem appropriate and make the necessary modifications in the system. For example, an organization that is recognized for successfully transforming to Agile has only two rules for the teams: iteration length should be two weeks and the shared electronic tool should be updated with all relevant data on a real-time basis.

Safe to fail experiments

The disruptions caused by change, particularly change that is technology related, mean that a business will repeatedly encounter unprecedented situations, for example, blockchain, which was perhaps unimaginable a decade ago. It can be a threat or an opportunity, depending on how a bank deals with it.

An enterprise must have the culture of innovation, if it is to spot and also create opportunities that a changing environment presents. Innovation can come only from experimentation. To foster a culture of innovation, the business should encourage people to stay away from the "we have always done it this way" mindset and more toward a culture of trying something new.

However, risk and experimentation go together, and if risk is not understood and contained, it can be disastrous for the company. The Ford Edsel car is a classic case study in this regard. Ford wanted to develop a premium car for middle class Americans. Ford was so confident about the car that it planned to introduce 18 variants of the car at launch. At launch, the car was too expensive, was a "gas guzzler," and was mocked in the press. Ford had to write off $350 million for this failure, which in today's terms is close to $3 billion.

Some ideas can be just ahead of their time (for example, the Newton MessagePad introduced in the early 1990s) while the customers may simply not like some ideas (for example, Crystal Pepsi). From an enterprise perspective, there are two takeaways: 1) it's important to get feedback as early as possible to know whether something should move forward or should be stopped, and 2) risks should be taken only to the extent where it is possible to recover quickly from failure and ensure that the risk does not prove fatal for the company. In summary, an enterprise must strive to strike that fine balance between order and chaos, as too much order impedes agility and chaos destroys agility.

Prioritize effectiveness over efficiency

Under perfect conditions of stability, trade-offs may not be necessary between effectiveness and efficiency. However, in reality, this trade-off is always there. Most businesses, as a rule of thumb, appear to favor efficiency over effectiveness. Some of the key reasons for this include the following:

- Manufacturing orientation, where identical things are produced in large quantities
- Short-term profit maximization orientation, due to pressure to show increasing profits every quarter

This becomes starkly clear when examining the KPIs chosen to define success and also those based on which C-level executives are incentivized and rewarded. A CAS, however, prioritizes effectiveness over efficiency, when the trade-off has to be made. This is perhaps the best way to deal with a changing environment when survival is at stake.

Enterprises need to change their orientation to prioritize effectiveness over efficiency, when there is a necessity to make the trade-off. A business may be highly efficient by producing its products at the lowest possible cost, but, to save costs, it may not spend on learning about the customers' changing preferences. As a result, the company can achieve higher profitability in the short run, but will lose customers in the long run, thereby losing both revenue and profits. The swift downfall of Blockbuster [xviii], which was the leader in the video rental industry, is a case in point. A critical part of its revenue model was charging late fees to customers. When Netflix came up with a model which made late fees redundant, Blockbuster went bankrupt in no time.

An organization must spend, as needed, time, effort, and money on enabling a learning and knowledge-driven culture, which helps its people to effectively adapt and respond to the fast-changing environment. Knowledge workers should primarily be accountable for effectiveness, that is, getting the desired outcomes, and secondarily for efficiency, that is, doing things at the least cost.

Monitor and leverage patterns

The emergent nature of CAS implies that patterns will surface at all levels of the enterprise, which will be based on the behavior of the agents, as well as the behavior of the system itself, for example, people becoming tense during performance appraisal periods could be a pattern. These patterns can lead to outcomes that are both desirable and not desirable. An example of an undesirable pattern is that decisions are being made by the **HIPPO** (stands for, **highest paid person's opinion**). Hence, patterns need to be monitored on a continuous basis, to encourage behaviors that lead to desired outcomes and conversely discourage behaviors that lead to undesirable outcomes.

It is also important to examine patterns that have become mental models, and challenge them, as some may be impediments to change. These patterns, therefore, should be dealt with first before introducing additional changes. Unless the feedback is a one-off, feedback should be consolidated into patterns. Patterns help in understanding the core issue quickly, without getting lost in the details. While details are important, not everyone should see the details or see them at all times. Patterns help in making information more consumable, thereby aiding the speed of communication, as well as knowledge transfer. There are significant implications of CAS modeling for leadership, which will be covered in *Chapter 5*, *Leadership*.

Summary

In this chapter, we learned that today enterprises are facing challenges which CASs have dealt with since time immemorial very effectively. They have been able to do so as they have all the capabilities of agility, only because they are living systems.

Understanding CAS modeling and embracing it, in order to infuse life into the business, is the first and fundamental step that companies should take as they embark/continue their journey toward agility. It will create a strong foundation that will support all other measures to boost agility.

The next chapter is the second of the three chapters in the foundation section. The chapter explores the significance of mindset and culture and how to influence them to become enablers for enhancing agility.

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