Designing for an Innovative Learning Organization

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System architects rely on their intuition when designing a system to support the work within an organization. Programming tradition leads the system architect to think of an office as a factory, a kind of machine. Machines are complicated, but not complex. An organization, a marketplace, and an ecosystem are not like machines. This paper suggests that a better understanding of the nature of an organization is necessary to design systems that allow a learning organization to excel. In order for an innovative organization to continually reinvent itself, the members need to be free to try new things. This individual experimentation is at odds with a system that constrains action to predefined patterns. Organizations are complex, and display antifragile qualities. Like other adaptive systems, organizations need a bit of change and stress in order to remain healthy. As more organizations become agile, system architects need to understand their needs and to know how to use a new generation of tools, such as adaptive case management, that support innovation and learning organizations.

Case management; business process management; knowledge workers; organizations; process technology; innovation; learning organization; antifragile

I. ANTIFRAGILE

Organizations hire knowledge workers so that they will think outside the box.[6] However, a Business Process Management (BPM) system used to automate work is often the box they are hired to think outside of.

This paper will consider process technology for innovative knowledge workers. What are the needs and requirements of such a learning organization? The way that IT systems can meet this need is not obvious because our intuition about organizations is not always correct. Let's start by exploring the concept of *antifragile*. This term was coined by Nassim Nicholas Taleb in his 2012 book "Antifragile: Things That Gain From Disorder."[1]

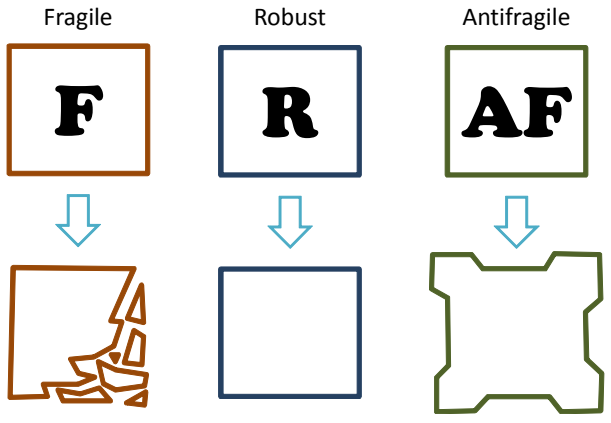

Figure 1: Depiction of Fragility Spectrum

We all know the meaning of *fragile*: When you stress something that is fragile, it might break. What is the opposite of fragile? Most people will readily suggest that the opposite of fragile is *robust*. Something that is robust is something that, when you stress it, it does not break; it remains the same.

There exist things that are less fragile than robust. When subjected to stress, these things not only resist change, they actually grow and get stronger. They actually get better when subjected to stress, and remain better after the stress is removed.

This notion is strikingly non intuitive. It is common sense that everything around you eventually wears out and breaks down. It may not happen all at once like a china teacup. Friction on the bearing of a wheel will eventually wear down and fail. Wind on a canvas tarp will eventually work the material and rip the weak spots. We simply know at an intuitive level that stress always causes things to wear out.

One might point to the laws of thermodynamics which state that entropy of a system must always increase; for something to get better might imply that entropy is decreasing, and therefore, antifragility is impossible. Yet, on further consideration, there actually are many things around us that demonstrate antifragility.

Consider muscles. If you exercise, the result will be increased size and strength of the muscles used. To learn to play the piano, you practice. Reading a book on piano technique is not effective. Only by actually sitting at the keyboard and working through songs will you gain proficiency. To learn to play tennis, you have to get out on the court and start hitting balls.

Learning in general is antifragile. Quizzes and exams are purposeful stresses that help to prepare a student for when they will have to face real situations. Performing a fire drill is clearly an unwanted extra stress that takes people away from their main job, but the result will be an organization better prepared for such an emergency. A fire drill teaches these behaviors far faster and more effectively than any amount of textbook learning.

Things that actually get better as the result of stress are known as adaptive systems. Antifragility is a property that emerges from a complex adaptive system. Complex adaptive systems are all around us; ecosystems, biological systems, organizations, marketplaces, social networks, the economy,

even our own muscles and brain. These do not behave like machines.

II. Machines

Complicated machine are made out of components, each providing a specific set of functions. Each part is made very precisely to performs that function. Machines that last are made as a hard and durable as possible. Parts fit together as perfectly as possible, with just the right gap to minimize friction and other degrading forces.

A good analogy for an idealized machine is a luxury mechanical watch. There are many gears, each made to fit precisely together with the other gears. The better watches have a jewel movement, which use a very hard stone at the pivot points. Built correctly, the watch will run for a very long time, and be very accurate.

It is rather obvious that machines are not adaptive systems. No matter how many times you run out of gas, the car does not get better about conserving fuel! (However the driver might.) Less obviously, we should understand that organizations are not machines, even though we like to think of them as machines. Organizations can learn and flexibly adapt to situations. The introduction of a new CEO, with a different management philosophy, can have the effect of redefining many jobs in the company, without any explicit orders being given. The roles that people play are not like the parts of a watch. People routinely fill in for others while they are away on vacation. Organizations do not wear out; they may come to an end in many different ways, but they never simply wear out. Organizations routinely do many things that a machine could never do.

III. Stability

Stability is desirable because it allows us to anticipate and be prepared for things before they happen. In many ways, the purpose of an IT system is to help support the stability of the organization. A well-functioning IT system will help smooth out the peaks and valleys of the business environment, and allow the personnel to perform more effectively. The organization gets more done because it uses its existing resources better.

Organizations do not achieve stability the same way that machines do. Remember, mechanical stability comes from designing parts very precisely and forming them from very hard materials. Even so, this stability is a temporary thing: the machine will eventually wear out.

An adaptive system achieves stability through *homeostasis*; this stability comes from a balance between different adapting forces. In an ecosystem, good weather may cause an increase in vegetation. In response the population of grazers might increase. Later, the population of predators might increase as well. The next year weather might be less productive, and grazing populations would be down, and so would the predators. These population proportions are not maintained by any central plan, but instead by a balance of different adaptive forces working off each other.

Thinking that adaptive systems should be treated like machines is a large part of what I call the *enlightenment bias*. This is a way of viewing the world using ideas from Descartes, Newton, and other Enlightenment philosophers who promoted the idea that behind every complicated phenomenon is a set of simple rules that define the behavior. These ideas were revolutionary at the time and led to a dramatic expansion in understanding of natural laws. These ideas were applied to management with the advent of Scientific Management where large complicated operations are seen to be decomposable into smaller, simpler steps that can be precisely and rigorously defined. Scientific Management is a part of our culture. We all learned that you should first plan, and then act. If you fail to act, then the fault can be attributed to poor planning. Plan better and you will act better in the future.

The ultimate expression of the enlightenment bias is in BPM systems where management attempts to define every possible detailed action that workers might take, and to find the optimal sequence of these actions. These system architects envision the organization as a kind of machine. They are trying to define very precise and very durable parts for that machine. This works for automating routine processes, but more and more organizations are turning to support for knowledge workers who do work that is anything but routine. At the level of knowledge workers, the organization is not a machine. It behaves more like an adaptive system, and applying machine principles can actually harm the organization.

"The only sustainable competitive advantage is an organization's ability to learn faster than the competition."
- Peter M. Senge[8]

IV. Adaptive Systems Crave Stress

Adaptive systems not only respond well to stress, they actually need stress. This seems surprising when stated that way, but we already know of many examples around us.

If you don't use muscles, they atrophy; they shrink and become weaker. A large muscle uses resources, and that is a

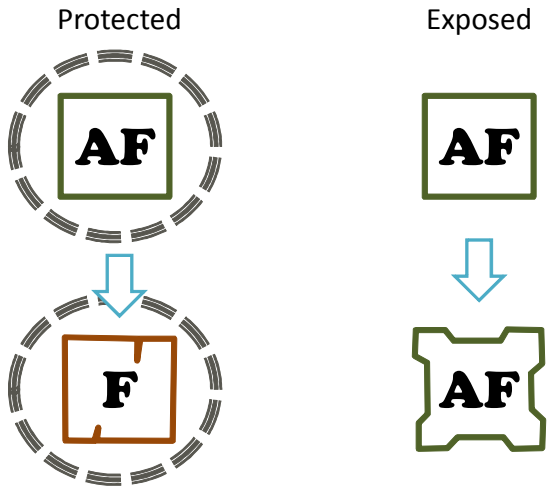

Figure 2: Protected and unprotected antifragile systems.

waste if a large muscle is not necessary. Growing and shrinking muscles are the balancing adaptive forces that allow the body to optimize resource usage. Yet if muscle strength declines too far, it is possible to be injured by something that a normally healthy person would not be hurt by. So exercise is an important part of remaining healthy.

If a forest is protected from fires, the undergrowth grows up, and makes the forest more susceptible to fires, and if a fire breaks out it is likely to do far more damage. The policy of preventing all fires in a forest has had the disastrous consequence of indirectly causing far larger and more damaging fires that are harder to recover from. In a very real sense, protecting a forest from fire makes it grow weaker. To maintain the strength of a forest, you need to have regular, modest sized forest fires.[7]

Here is the surprising conclusion: adaptive systems need a certain amount of stress. If they are protected from all stress they become fragile.

This rule applies to organizations. I mentioned earlier that fire drills are required to ensure that the employees are prepared for the case that an actual fire occurs. Suspending all fire drills will cause the organization to be less prepared for fire. Emergency response teams that do not drill themselves on different simulations and scenarios in advance would find themselves ill-prepared to meet the next unexpected situation.

If a football team wants to win the championship, it does so by practicing and playing many scrimmage games on the field. If it spent the time instead sitting still, resting, and conserving muscle movement, team members would be less likely to win the game. Unlike a machine, a team is an adaptive system, which gains from being exercised, and is actually harmed if it does not exercise.

Such exercise must include variations. Olympic swimmer Michael Phelps was forced by his coach to swim in unexpected circumstances: sometimes with the lights turned off, sometimes woken up in the middle of the night without warning.[4] This intentional variation in training has been credited with his ability to win a gold medal in the Beijing Olympics even though his goggles cracked and filled with water. [3]

The central point of Taleb's book was that antifragile systems crave stress, and if you withhold stress, they wither or become dangerously unstable. He said: “Stability is a Time Bomb.” While an adaptive system is able to readily accommodate modest perturbations, if you protect the system from those changes, attempting to provide a static environment, then the system becomes fragile and dangerous.

Business teams crave stress as well. Running simulations and scenarios as a business team is a well-known way to improve team performance. Doing things differently allows the team to understand how to coordinate on the fly. Then, if a situation comes along where the team has to do things differently, they are more prepared to meet this challenge.

V. The Best Practice Conundrum

It is ironic that the very purpose of most business process management initiatives is to find the single best practice, and institute that best practice by forcing employees to follow it. Here we get to the central theme of this paper; enforcing a single best practice on an organization *can make it fragile*.

This can be hard to understand for a system architect who thinks of an organization as a machine. After all, a diesel truck will perform best at a particular speed in a particular gear. A truck driver wants to find that speed and gear and use it whenever the situation is favorable. But organizations are more like muscles than trucks.

A swim coach searching for the single best practice might run a lot of tests, and conclude that an athlete swims best at 2:00 in the afternoon, after sleeping to 10am and when the pool temperature is 72 degrees. Instituting and enforcing this best practice might leave the swimmer exposed to the risks of performing poorly in competition if it is impossible to achieve the optimal preparation and environment.

The same thing happens in business teams. If a process is put into place that enforces that 'A' is done first, then 'B', and then 'C', the people working in the office come to expect it to always be this way. By acclimatizing to always having this pattern, the organization loses the ability to handle cases in any other order.

In a complex adaptive system constant stress is not to be mistaken as overreacting to noise but must be understood as environmental tuning information. We need to re-learn that in a complex world the notion of a single logical cause or a predictable outcome of an action is suspect. Constant, random stress is information that aligns the small anti-fragile system with the changes in its environment

This is not really a new idea. Management guru Tom Peters' 1988 book “Thriving on Chaos”[2] discusses organizations that thrive on the churn and turmoil around them. It is common to suggest that an organization needs occasional “shaking up” to keep it healthy. Agile software methodology works on understanding that software development is complex and unpredictable, and does not try to define everything perfectly in advance.

The system we speak of here is the *organization*, not just the computer system. The computer system may or may not be adaptive on its own. Our goal is clearly to make the business run better, and that involves people as well as the computer system. Organizations are adaptive, and it is the role of IT systems to support that adaptiveness.

“A military force has no constant formation, water has no constant shape: the ability to gain victory by changing and adapting according to the opponent is called genius”

- Sun Tzu

VI. Planning as Part of Work

Part of the reason for attempting to identify and isolate the single best practice is to eliminate the need to spend time planning what to do. If there is a fully elaborated best practice, then there is no need to waste time planning. Planning is viewed as a waste, and if planning can be eliminated, then workers can spend all the time doing productive work.

That, at least, is the theory, but many leaders oppose this point of view. Consider the following two quotes:

"No plan survives contact with the enemy."
- Helmuth von Moltke the Elder
"Planning is essential, plans are worthless."
- Dwight D. Eisenhower

The military is the place where you might expect to see the most rigorously defined and standardized modes of operation, but these respected leaders go out of their way to stress the importance of the planning activity itself. The importance is not just the end result–the plan–but the actual activity of planning itself is important.

Translated to modern terms, it is almost as if Eisenhower was saying that it is important to model your business processes, but when you are done you can throw the resulting models away. It is not the models that have value, but the activity of doing the modeling is worthwhile.

From this we can conclude that planning itself should not be eliminated, but in fact should be done as part of work. A best practice should be enforced without question, but instead as a guideline that might, or might not, be followed. There should be a point where the team sits down and evaluates whether the best practice is going to work in this case, and if not, to come up with an alternative. Planning needs to remain part of what the knowledge worker does.

VII. Advances in Information Technology

We hire knowledge workers to think outside the box.[6] An IT system dedicated to anticipating every move of a knowledge worker in advance will simply be an elaborate box constraining what the knowledge worker can do. If we want organizations that are strong in the face of varying market conditions, if we want them to be responsive to new situations, then instead of enforcing a single best practice, the IT system should allow for myriad of different practices.

This is very surprising and quite disturbing. It flies in the face of everything we learned about finding and instituting the best practice. There are two approaches one might take to allow many varying paths, one I call the "radical" approach, and another I call the "innovator" approach.

The radical approach is to suggest that the information system itself should mix things up a bit. That is, it should randomly alter some parts of the business process in order to see what happens. This would exercise the workers in the same way that a vaccine exercises the immune system. Workers would certainly learn how to accommodate variations in the process, and they would certainly be able to accommodate future changes. In the long run the system might identify a novel, improved business process, however this approach is wasteful.

The less radical approach is the "innovator" approach in which knowledge workers are allowed to do the process differently if it seems necessary to them. This relies on the knowledge worker coming up with an idea about what might be a better way to do things. In my own personal experience many knowledge workers have plenty of ideas on how things might be done better. The innovator approach would allow them to try out their idea and see if it works.

This is not really a new idea either. Before the advent of BPM systems, managers would redesign their processes as needed when they thought they could do it better. Generally, if successful, they would be rewarded for "taking initiative." An IT system that enforces a particular best practice can actually stand in the way of these innovators, which is why we need specialized system that allow for these kinds of changes.

VIII. Adaptive Case Management

There is a broad spectrum of different types of process technology.[11,12] The term business process management is usually used to refer to technology that enforces a particular specific sequence of actions on the workers in an organization. When the process is not predictable enough to design in advance, we turn instead to case management. [9,10,14] Case management allows the knowledge worker to decide what to do next, based on expertise that they have gained in their particular job.

There are two primary types of case management. One is production case management (PCM) which is used in situations where there are a lot of people doing similar things, and it is possible to define the required actions ahead of time, even though the exact usage and sequence of those actions cannot be predicted. PCM applications are created by developers who design all the possible actions and make them available as menu items that the workers can use as they see necessary. A good example of a PCM use case is a help desk system where customers call in to get answers on how to use products.

The second type is adaptive case management (ACM)[5] where not only are the processes unpredictable, but even the actions that need to be done are not known in advance. Knowledge workers not only direct the course of the process, but can actually create new goals that have never been needed before. It is an adaptive case management system that is needed for knowledge workers to experiment with new ways of working. It does not constrain the workers to any given business pre-defined process. The process can be changed by any participant, and changing the process is a natural part of everyday activity.

A lot of IT systems claim an ability to change, but in most cases they assume that a specially trained person will do the changes. For ACM, when we say that the process can be changed by any knowledge worker, it is necessarily understood that no special skills or knowledge must be necessary for making these changes. The users must be not only *allowed*, but also *able* to make those changes. This requirement rules out most of the more formal ways of modeling processes which require specialized training.[13] The process must be expressed in a way that a completely untrained knowledge worker can modify at will.

One might think of this not as process modeling, but instead *planning*. Knowledge workers don't work on pre-planned units of work, but instead planning itself is part of doing the job.

This approach is very hard to accept by those who view an organization as a machine that operates on a set of simple principles. It runs contrary to the idea that there is a single best way to do something, and our goal is to find the one best way and make sure that everyone does it. Failure to accomplish goals in the organization is seen by these people as an inability to follow the best course.

No matter how challenging, a system architect must come to see an organization as an antifragile system, in order to be successful at designing a system to support knowledge workers. Some organizations understand this today. Upper management must come to realize that, as Sun Tzu put it, their organization has no constant formation, and they must stop putting in place fixed, rigid processes, or they will find themselves left behind by those whose organizations are like water, shifting to meet each new challenge.

"The future is uncertain—but this uncertainty is at the very heart of human creativity"

- Ilya Prigogine

IX. SUMMARY

Fragile: the quality that when disturbed has a propensity to break. Stressing a fragile object reduces or destroys its value.

Robust: the quality that when disturbed it remains the same. Stressing a robust object has no effect on it at all.

Antifragile: the quality that when disturbed it improves. Stressing an antifragile object actually makes it more valuable. Antifragility is a quality that emerges from an adaptive system. While it sounds crazy, there are adaptive systems all around us, and a human organization is one of those.

Not only do adaptive systems respond well to stress, they actually degrade when all stress is removed. Like muscles that need exercise, an organization needs a certain amount of variation in order to remain healthy.

Adaptive case management is an approach to supporting knowledge workers that does not constrain the working patterns to a predefined best practice. Instead, it allows knowledge workers to evaluate what the options are in this case, and to plan a course of action that might be unique for this case. It then focuses on communications about the plan, and in support of the plan.

Scientific managers and system architects who view their organization as having a fixed form with a single best mode of operation may find this approach uncomfortable. Experienced managers already know that knowledge workers are not simple gears in a clock, but are instead capable of the most if they can be allowed to experiment and find new innovative approaches to work. Case management is an approach to finally bridge this gap between business and IT for the support of knowledge workers.

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