4.6 Thinking complexity for managers

Throughout time men and women have developed ideas and practices for organizing and managing people and resources. Writings and artifacts in different cultures and at different times provide illustrations of tools and techniques that were invented or adapted as new situations arose.

For example, the Egyptians invented methods for forecasting, planning work and organizing labor to build their monuments and anticipate the impact of the River Nile on agriculture and commerce. Double-entry bookkeeping was invented by Italian merchants and bankers during the Renaissance to rationalize account keeping in a time of growing trade. In the late 19th and early 20th century, engineers such as the American Frederick Taylor and the Frenchman Henri Fayol invented and tested new management tools and practices to rationalize and standardize efforts in factories, mines and administrations. In the 1980s an American engineer by the name of Bill Smith developed the now famous Six Sigma approach to quality management to improve operations and achieve quality goals at Motorola.

Managers need management tools, and management tools must be continually appraised and improved to serve management.

In a business environment that is today characterized by rapid technological, economic and social change managers need to update their toolkit. A recent article in the Harvard Business Review noted:

> "The evolution of management has traced a classic S-curve. After a fast start in the early twentieth century, the pace of innovation gradually decelerated and in recent years has slowed to a crawl. Management, like the combustion engine, is a mature technology that must now be reinvented for a new age."

Russell Ackoff argued that we are shifting from a Machine Age to a Systems Age. A change of Age comes about with the appearance of dilemmas; problems that challenge the validity of the current world view and cannot be solved within it.

A systems perspective sees organizations, such as a company or an economy as systems of agents in interaction. Each agent is autonomous in so far as it has the ability to learn from its experiences and generate new responses. When agents learn and adapt their behaviors, we call these systems "complex adaptive systems".

According to the complexity theorist John Holland complex adaptive systems share three characteristics:

The first is evolution. Over time, parts attempt to improve their ability to survive in their interactions with their surrounding parts. They learn from feedback and they adapt.

The second is aggregate behavior. As we saw in chapter 2, global systems behavior emerges from the interaction between parts or agents. Often it is this aggregate behavior that we would like to understand and modify and to do so, we must understand how the aggregate behavior emerges.

The third characteristic is anticipation. In seeking to adapt to changing circumstance, the parts or agents develop rules that anticipate the consequences of certain responses.

An example of a complex adaptive system is the stock market. It is a system

> "comprised of many traders with idiosyncratic beliefs about the future. The actors exchange information and react to some types of common information, but stock prices are largely

> determined by a large number of buy and sell decisions […] Movements in stock prices influence the beliefs of individual traders and in turn influence their subsequent decisions."

In complex adaptive systems, there is constant action and reaction to what other agents are doing. Individual parts are continually revising their rules for interaction with other the parts in the system that are also changing their behaviors. Nothing in the environment is fixed. It is never stable and it never reaches an "optimal" point.

This creates a problem for classical theories in fields such as economics that concentrate on optimal end-points. Complexity economics has emerged to address some of the limits of classical economic theory. It acknowledges feedback processes and path dependency, and recognizes that individual choices are made based on the decisions of others and that large-scale patterns in the economy emerge from the micro level behaviors of actors, adaptation and learning over time.

Managing in complex adaptive systems involves recognizing and accepting their inherent unpredictability and favoring improvisation, experimentation, trial and error and self-organization over foresight, command and control.

Computer simulations show that we can predict general archetypal behavior of a complex adaptive system, but not the specific outcomes. Management scholar Ralph Stacey concludes that

> "we might experience more success in predicting the behavior of organizations if we focus on what kinds of archetypal behavior tend to be produced by what general kinds of schemas, rather than trying to forecast the specific outcomes of specific actions."

Of course, not all management practices and tools need to change. Managers will still need to forecast, plan and control to continue executing existing operations efficiently. The challenge will be to develop practices and tools to help their organizations adapt to rapidly changing environments at the same time.