TARGETED INNOVATION

Using Systems Thinking to Increase the Benefits of Innovation Efforts

by Daniel Aronson

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Everywhere competition is more intense, with companies and departments having to do more with less. As competition increases, the importance of getting the greatest benefit out of innovation efforts increases. One powerful way to increase the benefits of innovation efforts is to target them so they result in innovations that are more strategically useful and thus have greater benefits for the organization.

Getting the Most Out of Innovation Efforts

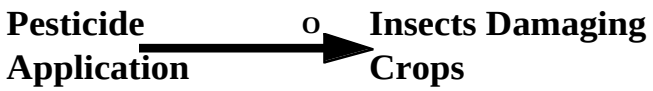
The key to making an innovation lead to greater improvement is to understand where it fits into the bigger picture of the company and its needs. Systems thinking, a field pioneered by Professor Jay Forrester of MIT, can play a key role in producing the understanding of the overall system needed to target innovation efforts more effectively. Systems thinking does this by providing a methodology and a set of tools for constructing maps of systems and determining the points at which change can have the greatest impact on a company's performance. This article will provide an introduction to some of the foundations and concepts of systems thinking, and will demonstrate how using it with innovation efforts can dramatically increase the chances that your innovation efforts will create lasting value for your organization.

The Systems Thinking Approach

The approach of systems thinking is fundamentally different from that of traditional forms of analysis. Instead of focusing on the individual pieces of what is being studied, systems thinking focuses on the *feedback relationships* between the thing being studied and the other parts of system. Therefore instead of isolating smaller and smaller parts of a system, systems thinking involves a broader view, looking at larger and larger numbers of interactions. In this way, systems thinking creates a better understanding of the big picture.

Innovation With The System In Mind

As an example of how this better understanding of the big picture can increase the benefits of innovation, consider the department of an agricultural firm charged with finding a way to reduce the crop damage created by insects that have proven resistant to common pesticides. One way to approach the problem would be to create an especially strong pesticide that is designed to be potent enough to kill even these unusually resistant insects. The company might then instruct their researchers to develop such a strong pesticide for them to use on their crops. The reasoning behind this course of action can be shown as follows:



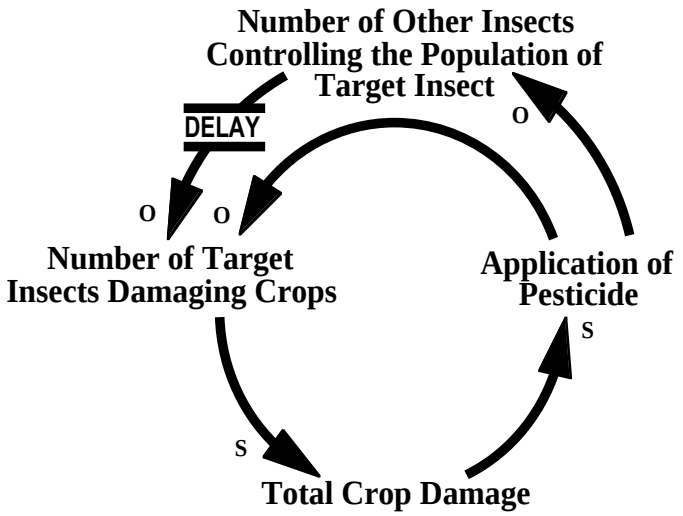
In this diagram, the arrows represent the direction of causality—one element causing the other to change—while the *o* represents how one makes the other change. The *o* next to the arrow from *Pesticide Application* to *Insects Damaging Crops* means that *Pesticide Application* causes *Insects Damaging Crops* to change in the opposite way it does—if the application of pesticides increases, the number of insects damaging crops goes down, a change in the opposite direction.

The problem in this case is that the researchers have been asked to do something based on a faulty understanding of the system, and so the department's success at producing a stronger pesticide may not translate into lasting benefit for the company as a whole—in fact, the strategy may backfire. The reason for this is that the policy is based on an understanding of the system that, while not wrong *per se*, is incomplete—it leaves out the feedback relationships involved.

A View of the Big Picture

The diagram below shows a picture of the system that captures the set of interactions that are likely, in fact, to make the company's strategy backfire:

While the application of the stronger pesticide indeed reduces the numbers of the target insect—and thus the total crop damage—in the short run (as shown in the inner loop from *Application of Pesticide* to *Number of Target Insects Damaging Crops*), it kills even more of the other insects in the area than it does of the target insect because—as mentioned earlier—the target insect is more resistant to pesticides than other insects are.



Some of the insects killed by the pesticide helped control the population of the target insects by preying or competing with them (as shown by the connection between *Number of Other Insects Controlling the Population of Target Insect* and *Number of Target Insects Damaging Crops*). When these insects are killed, the degree of control they exerted on the population of the target insect is lessened. (This effect is shown in the outer loop from *Application of Pesticide* to *Number of Other Insects Controlling the Population of Target Insect.*)

Reduced Long-Term Effectiveness

Eventually, as the target insects recover from the effects of the pesticide, the lessening of the control that had been provided by other insects leads to an explosion in the population of the target insect. As the population of the target insect goes up, so does total crop damage, as the link between *Number of Target Insects Damaging Crops* and *Total Crop Damage* shows. (The *s* indicates that the two change in the same direction—as the number of target insects goes up, so does the total crop damage.)

This leads to even greater crop damage than before, encouraging the company to apply the pesticide again—in the language of the diagram, as *Total Crop Damage* goes up, *Application of Pesticide* goes up (with the *s* again indicating that they change in the same direction). However, even the temporary gains originally made by applying the new pesticide begin to lessen as the target insect becomes more resistant to it and, as a result, crop damage continues to get worse. What worked well at the beginning does not work nearly as well any more, and the benefits of the company's innovation efforts begin to evaporate.

Local Success, Global Failure

In this case, the very effectiveness with which the researchers did what they were asked to do—create a stronger pesticide—served to make the original problem *worse* because the side effects of using a more powerful pesticide were not considered. An understanding of the interactions that produced these side effects would have enabled the company to see that their plan to use a stronger pesticide was likely to backfire. They would also have been able to consider other options that would not backfire, such as introducing more of the target insect's predators into the area and developing strains of the crops that were more resistant to insect damage. Giving the researchers either of these tasks would have led to an innovation that fit better into the big picture and as a result created substantial, lasting benefit.

The Benefits of Big Picture Innovation

As this example shows, systems thinking can provide some of its greatest benefit by giving companies a way to make sure that the benefits of their innovation efforts are not compromised by the lack of a big picture understanding. Without requiring any additional resources, innovation efforts targeted with the big picture in mind can produce greater, lasting benefits for the organization, and a company that gets more benefit from its innovation efforts will have a competitive advantage over its rivals.

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