



Joint Programs and Social Dilemmas

featuring Bill Novak interviewed by Heidi Brayer

Heidi Brayer: Welcome to the SEI Podcast Series, a production of the Carnegie Mellon Software Engineering Institute. The SEI is a federally funded research and development center at Carnegie Mellon University in Pittsburgh, Pennsylvania. To learn more about the SEI, please visit our website at www.sei.cmu.edu. A transcript of today's podcast will be posted on the SEI website at www.sei.cmu.edu/podcasts. My name is Heidi Brayer, and today I'm pleased to introduce you to [Bill Novak](#), a senior member of the technical staff in the SEI's [Acquisition Support Program](#) [now the Software Solutions Division]. Bill currently works in the program's Air Force team supporting acquisition program clients, assessing programs, teaching classes, and conducting research and development on the dynamics of acquisition program behavior. In today's podcast, Bill will be discussing joint programs and social dilemmas, which have become increasingly common in defense acquisition, and the ways in which joint program outcomes can be affected by their underlying structure. Welcome, Bill.

Bill Novak: Happy to be here.

Heidi: Bill, let's start off by having you give us some background about joint programs and their role in defense acquisition.

Bill: Sure. Joint programs are appealing to the military because they offer two big potential benefits. The first is reducing costs by developing one system as opposed to several. The second is improving interoperability by producing a single, standard implementation of a capability that will then be used by multiple different systems, avoiding the conflicts that can come from having multiple differing implementations of the same standard. These are major advantages.

Unfortunately, joint programs are also recognized as being especially hard to manage for a number of reasons. They're larger than most other programs. They typically have a large number of stakeholders, often with differing goals. They're more complex organizationally. They're often geographically spread out. There are a lot of coordination overhead and communication issues, and so on. Sometimes you hear of people refer to jointness as the "J word" because of all the challenges that come along with it.



There are other types of programs that may not be technically joint programs, which have similar characteristics. For example, a common infrastructure system such as an enterprise-wide IT [information technology] system has a lot of similarities to a joint program. Both are often trying to replace a set of isolated yet related capabilities with a single, new integrated system that will then do everything in a more modernized way.

Heidi: Bill, tell me a little bit about how you got involved in joint programs and social dilemmas research. And, given your experience, do they all have the same types of issues?

Bill: Well, the SEI gets involved pretty regularly in assessments of different types of programs including a number of joint programs. So, we're able to get a good look at what happens on the inside. So, as far as what actually happens across different joint programs, here's a general scenario that we've seen happen on several different joint programs, and it seems to be representative of others:

Let's say we have a joint program office that has a number of different stakeholder programs that are planning to use the joint infrastructure software that's being developed. However, each of the stakeholder programs demands that at least one major feature be added to the software, just for them, to support their specific mission but which really won't be used by the other programs. The joint program manager reluctantly agrees to each of these additional requirements for fear of losing the stakeholders who could always go off and build their own custom software. As the JPO [joint program officer] fears, the additional design and coding changes that must be made to the system drive up the total program cost, schedule, complexity, and risk. As the schedule now begins to slip, one program decides to leave the joint program and develop its own custom software instead. With one stakeholder gone, the amortized cost for the other programs increases further, and another program leaves. As the cost escalates, and the schedule continues to slip, participation in the joint program unravels further and could ultimately collapse.

Heidi: Well, that's certainly not the way things are supposed to work out. How does it happen that everyone starts out with the best intentions, but things end up so badly?

Bill: It turns out that the failure of this joint program is an instance of a pattern that's called "[The Tragedy of the Commons](#)." It was described by [Garrett Hardin](#) in 1968 to illustrate a common way in which planned cooperation can turn into opposition.

The original story from the 19th century goes like this:

Imagine a group of herders who share a piece of grazing land called a commons. If one herder decides to graze another animal, then that herder gets more benefit from the commons than the others do at no additional cost to himself. However, if all the herders

follow suit and add even more animals according to the same reasoning, they eventually reach the point where the grass is eaten faster than it can regrow. The cattle begin to starve, and ultimately all the herders lose their livelihood.

What's interesting is that no one herder is the villain in this story, and no one intended to destroy the commons. It is the combined actions of everyone acting in their own self-interest that lead to the tragic result.

We can solve the moral of the story of the tragedy of the commons very simply. An individual desires a benefit to himself that will cost everyone else, and if all succumb to the same temptation then everyone is worse off. We see instances of the tragedy of the commons all around us. For example, all fishermen want to catch as many fish as possible, but if all of them do, at some point there won't be any more fish. Or, everyone wants to drive their own car to work because it is convenient, but if everyone does the roads become too congested to use.

You can see the same thing taking place in the joint program where the program itself is the commons, and the stakeholder programs are the herders. The stakeholders each want the benefit of a custom feature, but if they all demand one then everyone ends up worse off.

Heidi: Bill, are there other instances of the tragedy of the commons in acquisition besides joint programs?

Bill: There are a lot of other examples. For starters, if program office reviewers can't easily distinguish lower-quality-deliverables from higher-quality-deliverables that take more effort to produce, then eventually lower-quality-deliverables will drive out those of higher quality, since there's not much reason to spend the extra effort to produce high-quality results.

Another example? Given the importance of cost and source selection, contractors may under bid their development proposals to try to win more contracts expecting to make the money back either in engineering changes or on the production contract. When other contractors see this approach being successful, they follow suit leading to increasingly inaccurate bid estimates by all contractors and growing costs and schedule overruns.

Heidi: Bill, I can see that the tragedy of the commons isn't just an intriguing problem but one that looks like it still very much with us today. Have we been making progress on this problem?

Bill: There's been a great deal of study done on it, and there has been good progress. In 2009, [Elinor Ostrom](#) received the Nobel Prize in Economics for her work on studying instances of the tragedy of the commons and ways that different groups have found for addressing it.

Still it's far from being a solved problem. The tragedy of the commons actually represents one of two categories of problems in cooperation that are called social dilemmas. The tragedy of the

commons is what is called a social trap. There's another category of social dilemmas that's called a social fence.

Heidi: Okay, Bill. You've introduced another term here. What can you tell us about social fences?

Bill: A social fence is similar to a social trap but turned around. In a social fence everyone desires a benefit that will cost each individual, but if no one pays their cost, the benefit might never happen. It's often referred to as the public-good problem, as in something that's good for the general public.

The problem is that few people want to pay to create a public good even though everyone will benefit from it. For example, historically, lighthouses were needed by all ships to navigate safely, but not all ship owners wanted to pay for building and maintaining them, making it difficult to create something even when most everyone realized it was needed.

In acquisition, let's say a program has developed a brand new piece of untried infrastructure software that can be used in a number of different platforms. The problem is that no one wants to commit to using it. They all know that it's better to wait for another program to take the risk of trying out the new software and having cost and schedule difficulties while they work out the bugs. Better that they deal with that than risk problems on your program if the infrastructure isn't up to expectations.

Another acquisition example is risk management. Good risk management is considered to be key to a program's success. But, if acquisition leadership starts to see those who are reporting risk as creating problems for the program, people will simply stop reporting risks and won't be willing to pay that personal cost just for the good of the program.

Heidi: So tell us, what can be done to try to mitigate the effects of these social dilemmas?

Bill: Social dilemmas come in many different forms with different properties, which is partly why they can be hard to fix. That's why we keep seeing them, not just in acquisition but in public policy, economics, sociology, and many other areas.

Still, there are a number of different solutions that have been identified and which can be applied. For example, one approach to resolving the tragedy of the commons is to have a designated authority regulate all use of the shared resource, preventing it from being exploited or overused. While this can be effective in many situations, it can also be both difficult and unpopular to enforce a mandate across the different services in the DoD [Department of Defense].

Another possible approach is privatization, where the commons is broken up into private areas, one for each herder, perhaps by putting up fences. Now each owner has a strong incentive to

properly manage and care for what they own. Unfortunately, in the case of a joint program, privatization may defeat the intent of cooperating to achieve cost savings interoperability. In the joint program scenario, for example, privatization would mean that each of the stakeholder programs would build their own custom system, an approach that defeats the purpose of having a joint program in the first place.

A more promising solution might be something called [altruistic punishment](#) which was proposed by Ernst Fehr and Simon Gachter in 2003. In this approach, cooperating participants can penalize those who are being uncooperative in some way to encourage them to cooperate. They found that people are willing to do this even if the penalty costs the cooperators to impose it and may produce no immediate direct benefit for them. The cost of imposing the penalty prevents its overuse, making it self-correcting, and the research shows the cooperation improves significantly when altruistic punishment is used.

So, in our joint program example, altruistic punishment might take the form of a financial penalty, such as a small reduction in the budget of the program being punished, which stakeholders can impose on one stakeholder who isn't cooperating. However, imposing that budget reduction would also have a cost to the stakeholder who chooses to mete out that punishment. The point would be to encourage the stakeholder programs to stay with the joint program, if possible, despite any difficulties. Even if it turned out that the altruistic punishment approach were unsuitable for application in a situation like a joint program, many other solutions to the tragedy of the commons dilemma still exist including insurance contracts, rewards, building trusts, and exclusion mechanisms. The choice of the best solution very much depends on the specific circumstances of the program.

Heidi: Bill, what recommendations would you have for acquisition program leaders who are working with joint programs and facing some of these issues that you're describing?

Bill: Well, the SEI is continuing to do research in this area to develop better ways of analyzing and dealing with the kinds of issues that come up in the joint program scenario I described. At this point, there are a few things that I would recommend that acquisition program leaders consider doing.

Remember that the tragedy of the commons and, by extension, joint programs are all about cooperation. So, first, if you're involved in a joint program, you need to raise awareness across the effort of the nature of the dilemma the program is facing so that everyone knows what can happen, and that what each person does individually matters to the outcome of the program as a whole.

Second, setting an example and an expectation of cooperation for everyone involved can help. Once people see that example being set, the most common reaction is, “Well, if someone else is doing it, then I can too.” And, that can really help cooperation.

Third, again, since this is about cooperation, the rewards offered by the program need to be focused on rewarding the group as a whole for working together, cooperatively. Rewarding the group performance promotes cooperation. Rewarding individual performance can actively reduce cooperation.

Some other suggestions are to be careful about working with stakeholder programs that have a critical, near-term need for the joint systems being developed. These kinds of programs are the highest risk to any joint effort, as they’re likely to be the first to want to opt-out of the joint program if it experiences any kind of schedule slip, an all too common occurrence. Also, try to incentivize the use of the joint system by the stakeholder programs in some way. This can help to balance the inevitable risk they have with at least some level of benefit.

Heidi: Bill, thank you for joining us today. This recording and a downloadable transcript are available at sei.cmu.edu/podcasts [and on [Carnegie Mellon University's iTunes U channel](#)]. If you have any questions, please e-mail us at info@sei.cmu.edu.