Process Innovation

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Last month we introduced readers to Process-TRIZ (P-TRIZ), a new method of use to anyone documenting, analyzing, or re-designing business processes. Developed by Mark Burnett and Howard Smith at Computer Sciences Corporation, P-TRIZ is a methodology for identifying process reengineering options and the associated solutions.

While workflow, rules engines and BPM systems are proving effective at introducing new processes[1], the design of such processes has to be determined before they can be deployed – with or without new technology. That's where P-TRIZ can help. In this article, I show how a P-TRIZ model is used to generate an exhaustive list of re-design options. This first step in P-TRIZ is called *formulation.*

In P-TRIZ, every process model (swimlane model, BPMN diagram etc.) can be accompanied by one or more corresponding *process innovation models.* Where the swimlane model describes how the process should execute, the process innovation model describes how the process can be *improved or re-invented.*

Process innovation models are easy to read and are a great aid to communicating what is good and bad about any process. The notation requires only two types of boxes and two types of lines:

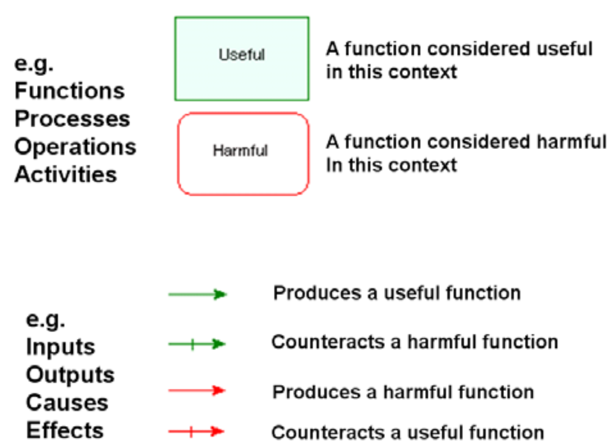

Figure 1 – P-TRIZ notation

A green box indicates anything useful about a process. It could refer to the whole process, a sub-process, a specific function of the process, an activity in the process or any other aspect of the process. It could even refer to an abstract concept such as how the process is perceived by a business user or customer. All these entities are called, in P-TRIZ, "functions." Functions serve a very general purpose in P-TRIZ.

Harmful functions are indicated in red. Useful functions are indicated in green. Any function (useful or harmful) can produce another function (useful or harmful). What's considered useful or harmful is a matter of perspective. Cost, for example, is useful to a supplier, harmful to a customer. The idea is this: The combustion engine produces useful travel, which produces a useful fluid economy, but also consumes fuel, creating cost, and produces harmful emissions, which damage the environment. Fuel consumption is useful to the oil industry in creating profits. Even the harmful emissions may be considered useful inasmuch as they drive us towards creating more sustainable solutions.

Here is a very simple P-TRIZ model: a useful process P produces harmful costs C. This would be represented as follows:

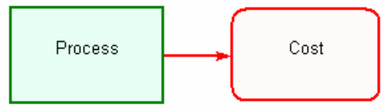

Figure 2 – All processes have harmful associated costs

Conversely, harmful functions can also be useful. For example:

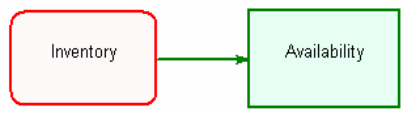

Figure 3 – The cost of inventory nevertheless provides availability

In P-TRIZ, functions (useful or harmful) can also *counteract* other functions (useful or harmful). Here is an elementary model of a Sales process:

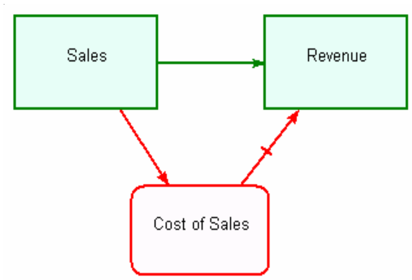

Figure 4 – P-TRIZ model of the Sales Process

What this model says is: Sales is useful, because it generates Revenue. But it is also harmful, in that the harmful Cost of Sales counteracts Revenue. We can continue to model any process in this way, to any degree of detail. Figure 5 illustrates a fragment of a manufacturing production process:

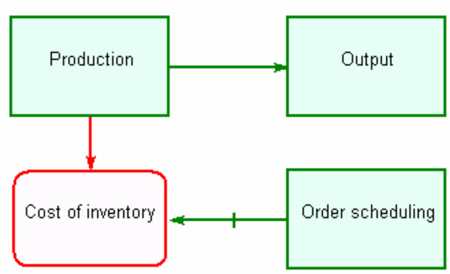

Figure 5 – A harmful factor of the production process: inventory

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The model fragment states that: Production produces useful Output, but is also a harmful Cost of inventory. This is counteracted by a useful Order Scheduling system.

Models like this are very extensible. For example, the Cost of inventory is not only harmful, it is also useful: inventory allows orders to be fulfilled from stock. Other harmful functions could be added to the model, including the cost of labor, the cost of materials and the cost of shipping.

P-TRIZ is Exhaustive

How many ways are there to re-design a process? If all we know about a process is that it is useful, all we can do is improve it or replace it with a better version. Only by clarifying our perspectives on the functions within a process can we discover more options. By decomposing a process into its useful and harmful elements, options are generated for improvements that are far from obvious at the outset. We use P-TRIZ to define, for the process, what we consider useful and what we consider harmful. From such a model it is possible to automate the generation of re-design alternatives. This is typically performed by a software tool, although it can be done manually. This step, automated or manual, is called P-TRIZ *formulation*. The simplest case is represented in Figure 6. This says: there is a Process, which provides useful Output, but also incurs harmful Cost:

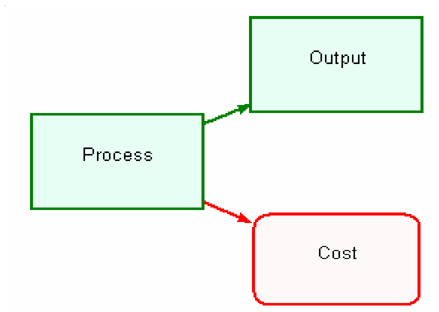

Figure 6 – A simple process model

Even though this model consists of only three boxes, P-TRIZ generates the following business process reengineering alternatives:

1. Find an alternative way to obtain [the] (Process) that offers the following: provides or enhances [the] (Output), does not cause [the] (Cost).

2. Try to resolve the following contradiction: The useful factor [the] (Process) should be in place in order to provide or enhance [the] (Output), and should not exist in order to avoid [the] (Cost).

3. Find an alternative way to obtain [the] (Output) that does not require [the] (Process).

4. Consider replacing the entire system with an alternative one that will provide [the] (Output).

5. Find a way to eliminate, reduce, or prevent [the] (Cost) under the conditions of [the] (Process).

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These five statements are called the primary or fundamental reengineering options in P-TRIZ. Solving any one of these will improve the process. Read each carefully and you will see that they are indeed unique and distinctive strategies. Want more options? P-TRIZ can generate many more:

1.1. Find a way to increase the effectiveness of [the] (Process).

1.2. Find additional benefits from [the] (Process).

1.3. Find a way to obtain [the] (Output) without the use of [the] (Process).

1.4. Find a way to decrease the ability of [the] (Process) to cause [the] (Cost).

3.1. Find a way to increase the effectiveness of [the] (Output).

3.2. Find additional benefits from [the] (Output).

4.1. Consider transition to the next generation of the system that provides [the] (Output), but which will not have the existing problem.

4.2. Consider enhancing the current means by which the primary useful function is achieved, to the extent that the benefits will override the primary problem.

4.3. Consider giving up the primary useful function to avoid the primary problem.

5.1. Find a way to benefit from [the] (Cost).

5.2. Try to cope with [the] (Cost).

5.3. Consider ways to compensate for the harmful results of [the] (Cost).

5.4. Consider creating a situation that makes [the] (Cost) insignificant or unimportant.

As you can see, some of these second-level options involve *compromises.* Implementing one or more compromise solution would not fundamentally change the original process, but it could alleviate a key problem surrounding the original design. Direction 3.2 suggests finding additional benefits from the output so that we care less about the harmful costs. Direction 5.3 posits that there could be ways to counteract the costs, for example, to pass some of it onto supply chain members. And so on.

Causes and Effects Lead to an Understanding of Change

The interplay between useful and harmful functions is called a *cause-effect model.* As we begin to sketch out a real world process in P-TRIZ we see cause-effect patterns emerging. Here for example is a common and generalized pattern at the heart of many real world processes:

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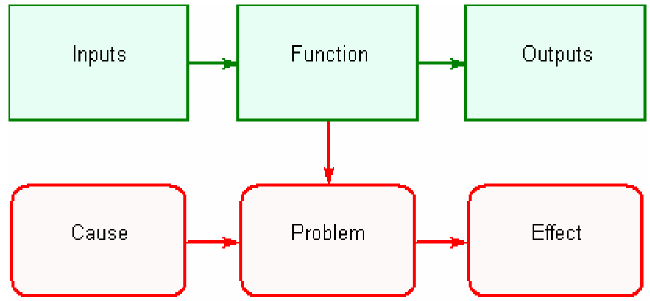

Figure 7 – Elementary P-TRIZ Process Pattern

What this model says is: There is a Process (the whole of Figure 7), which performs a useful Function, by consuming Inputs and producing Outputs, but which also has harmful side effects (Problem) which arise from Causes and produce harmful Effects. Listed below are the top-level reengineering options generated from that model. (The second level options have been excluded for brevity.) Read each in turn and you will see that they all make perfect sense:

1. Find an alternative way to obtain [the] (Function) that offers the following: provides or enhances [the] (Outputs), does not cause [the] (Problem), does not require [the] (Inputs).

2. Try to resolve the following contradiction: The useful factor [the] (Function) should be in place in order to provide or enhance [the] (Outputs), and should not exist in order to avoid [the] (Problem).

3. Find an alternative way to obtain [the] (Inputs) that provides or enhances [the] (Function).

4. Find an alternative way to obtain [the] (Outputs) that does not require [the] (Function).

5. Consider replacing the entire system with an alternative one that will provide [the] (Outputs).

6. Find a way to eliminate, reduce, or prevent [the] (Problem) in order to avoid [the] (Effect), under the conditions of [the] (Cause) and (Function).

7. Find a way to eliminate, reduce, or prevent [the] (Cause) in order to avoid [the] (Problem).

8. Find a way to eliminate, reduce, or prevent [the] (Effect) under the conditions of [the] (Problem).

A Process for Process Innovation

P-TRIZ is a flexible tool and can be applied in many different ways. Models can be simple or complex. The tool is fast enough to be used in meetings, or even in return email, but is also comprehensive enough to sustain in depth analysis within demanding process improvement projects. The models and the generated directions greatly assist brainstorming, allow work to be divided out among team members, to structure an exploration for design alternatives and eventually (as we shall see in future articles) leads naturally to solutions. Solutions are, in

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P-TRIZ, alternate designs for the original process. P-TRIZ models, can, in a complete implementation of the methods, transform one process design into another.

Following a generated direction usually involves making a new model to explore its implications. This can generate still more options. The process is recursive.

P-TRIZ is typically applied to two types of processes: abstract or concrete. Figure 7 is an example of an abstract process. Many more exist and are being documented. Many will already be at work in your business, whether or not you recognize them.

Using P-TRIZ, a problematic abstract pattern (consisting of mostly red boxes) can be used to generate reusable re-design guidance. A useful abstract pattern (consisting of mostly green boxes) can be used to generate reusable improvement guidance. Think of the directions generated as *process next practices.* They are an effective way to manage an organization's process knowledge. The model diagrams and the generated directions can be included in reports or practitioner guides. P-TRIZ is opening the door to comprehensive *process knowledge management.*

When P-TRIZ is applied to a concrete process model, i.e. a model of a specific real world process, the names of the function boxes refer to the specific activities and participants in the process. From such a model, P-TRIZ will generate the specific reengineering options associated with the unique process design.

P-TRIZ can even be applied to itself, or, to the kind of process-improvement that is going on all the time in large businesses where complex process hierarchies serve many masters. Consider the following P-TRIZ model:

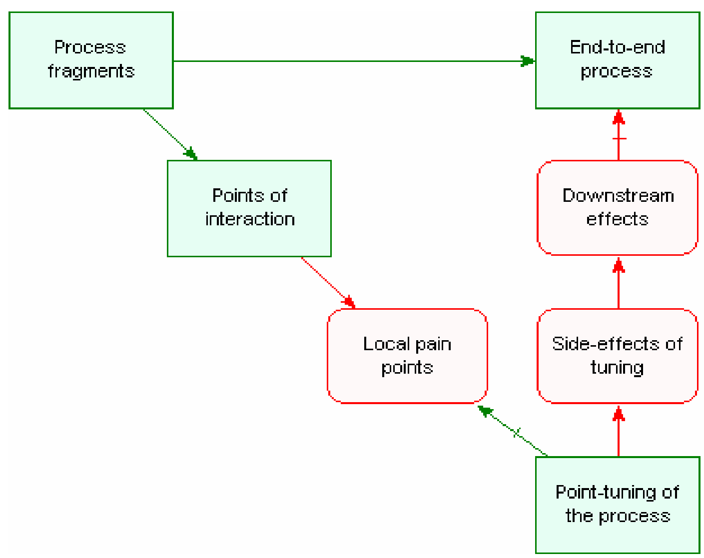

Figure 8 – A perspective on process change

Some process fragments look like the whole process to certain participants when, in fact, they are part of a bigger end-to-end process that has multiple

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participants and which serves multiple purposes. The overall process architecture can become quite complex as individual process fragments get utilised by multiple end-to-end processes.

When a particular interaction point with a process is seen as painful, participants or local process owners often tune the process at this point. Whilst alleviating the local pain, this can cause pain points in other parts of the larger processes and can even break some of the end-to-end processes altogether. P-TRIZ provides the rigour to assess both the potential benefits and harm that may result from changing a process to determine whether such a change would yield an overall improvement or not.

P-TRIZ can be used with or without another process modeling notation. There is no need to model a process in the traditional sense (swimlanes, activities, BPMN etc.) to use P-TRIZ effectively. Even if a formal process model does not exist, P-TRIZ can still be used to capture the desirable and undesirable characteristics of a process, leading to re-design options and (hopefully) to solutions. Thus, P-TRIZ can be used in front of, or behind, the process discovery phase.

P-TRIZ is based on TRIZ, a comprehensive methodology for innovation. The article *Do You Have Problems*[2] is a readable overview of modern TRIZ. More background can be found in *What Innovation Is*[3], a white paper of Computer Sciences Corporation which describes how companies are using methods included TRIZ to strengthen their process of innovation. P-TRIZ extends modern TRIZ so that it can be applied consistently in the world of business process management (BPM).

Appendix A

P-TRIZ is often used with very structured and well documented processes. In such a case P-TRIZ generates equally structured and specific re-design options. Yet P-TRIZ can also be applied when the process is unstructured, partially discovered or even contorted, circular or hidden. For example, Figure 9 shows a P-TRIZ model that describes the self-reinforcing nature of mega-projects:

P-TRIZ generates the following top-level strategies to solve the problems inherent to the mega-project scenario: (The second level of compromise or alleviation strategies have been excluded for the sake of brevity)

1. Find a way to eliminate, reduce, or prevent [the] (Mega Project) in order to avoid [the] (Long program duration) and (Large program scope).

2. Find a way to eliminate, reduce, or prevent [the] (Long program duration) under the conditions of [the] (Mega Project) and (Schedule slippage), then think how to provide [the] (Long planning horizon).

3. Try to resolve the following contradiction: The harmful factor [the] (Long program duration) should not exist in order to avoid harmful results and should be in place in order to provide or enhance [the] (Long planning horizon).

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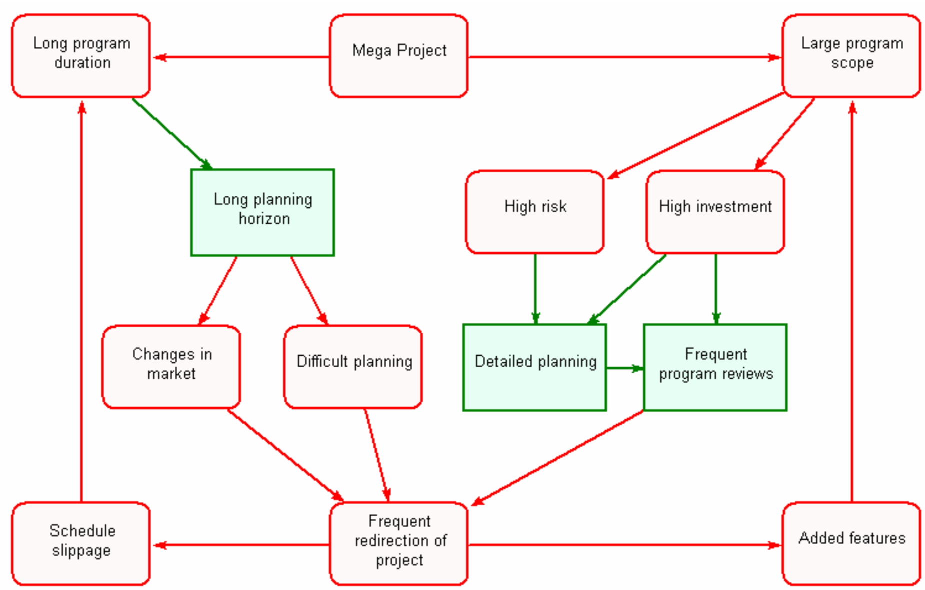

Figure 9 – The self-reinforcing nature of the processes within a mega-project, illustrated as a P-TRIZ model

4. Find a way to eliminate, reduce, or prevent [the] (Large program scope) in order to avoid [the] (High risk) and (High investment), under the conditions of [the] (Mega Project) and (Added features).

5. Find a way to eliminate, reduce, or prevent [the] (High risk) under the conditions of [the] (Large program scope), then think how to provide [the] (Detailed planning).

6. Try to resolve the following contradiction: The harmful factor [the] (High risk) should not exist in order to avoid harmful results and should be in place in order to provide or enhance [the] (Detailed planning).

7. Find a way to eliminate, reduce, or prevent [the] (High investment) under the conditions of [the] (Large program scope), then think how to provide [the] (Detailed planning) and (Frequent program reviews).

8. Try to resolve the following contradiction: The harmful factor [the] (High investment) should not exist in order to avoid harmful results and should be in place in order to provide or enhance [the] (Detailed planning) and (Frequent program reviews).

9. Find an alternative way to obtain [the] (Frequent program reviews) that offers the following: does not cause [the] (Frequent redirection of project), does not require [the] (Detailed planning) and (High investment).

10. Try to resolve the following contradiction: The useful factor [the] (Frequent program reviews) should be in place in order to fulfill useful purpose and should not exist in order to avoid [the] (Frequent redirection of project).

11. Find an alternative way to obtain [the] (Detailed planning) that offers the following: provides or enhances [the] (Frequent program reviews), does not require [the] (High risk) and (High investment).

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12. Find a way to eliminate, reduce, or prevent [the] (Frequent redirection of project) in order to avoid [the] (Schedule slippage) and (Added features), under the conditions of [the] (Difficult planning), (Changes in market) and (Frequent program reviews).

13. Find an alternative way to obtain [the] (Long planning horizon) that offers the following: does not cause [the] (Difficult planning) and (Changes in market), does not require [the] (Long program duration).

14. Try to resolve the following contradiction: The useful factor [the] (Long planning horizon) should be in place in order to fulfill useful purpose and should not exist in order to avoid [the] (Difficult planning) and (Changes in market).

15. Find a way to eliminate, reduce, or prevent [the] (Difficult planning) in order to avoid [the] (Frequent redirection of project), under the conditions of [the] (Long planning horizon).

16. Find a way to eliminate, reduce, or prevent [the] (Changes in market) in order to avoid [the] (Frequent redirection of project), under the conditions of [the] (Long planning horizon).

17. Find a way to eliminate, reduce, or prevent [the] (Schedule slippage) in order to avoid [the] (Long program duration), under the conditions of [the] (Frequent redirection of project).

18. Find a way to eliminate, reduce, or prevent [the] (Added features) in order to avoid [the] (Large program scope), under the conditions of [the] (Frequent redirection of project).

Footnotes

[1] Smith, H., "From CIO to CPO via BPM," Computer Sciences Corporation, http://www.csc.com/features/2005/38.shtml

[2] Smith, H., Burnett, M., "Do you have problems?" *The Leading Edge Forum,* June 2005,http://lef.csc.com/foundation/library/journal/06_05/433D6B413A68404C52484D575442.pdf

[3] Smith, H., "What Innovation Is", Computer Sciences Corporation, August 2004, http://www.csc.com/features/2004/57.shtml