

The Systems Thinking Tool Box

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“.. bump, bump, bump, on the back of his head. It is, as far as he knows the only way of coming downstairs, but sometimes he feels that there really is another way, if only he could stop bumping for a moment and think of it.”

Winnie the Pooh - A. A. Milne

Spray Diagram (SD)

What is it and what does it do?

A Spray Diagram is the output from a divergent thinking process that allows a team to:

- generate and capture thoughts and associated ideas about a situation or problem.
- communicate their ideas in a simple and powerful representation.

Why do it?

When attempting to understand a situation (or solve a problem) the task is to find amongst all the possibilities those critical aspects (or solution). Borne out of a reductionist mind set, we often attempt to do this in one step by “jumping” to the “answer” since we obtain an outcome quickly. This obsession with speed typically results in the wrong understanding or solution, thus requiring a return to, and reconsideration of, the situation or problem at a later date; typically at great expense in terms of cost and time.

Systems Thinking, however, asserts that we need to be more holistic and consider the whole of the situation or problem. Achieving this logically comprises two activities:

1. Generating information.
2. Organizing information.

These two activities require different mental skills and are often referred to as Divergent Thinking and Convergent Thinking respectively:

- Divergent Thinking: concerned with generating information and ideas about a problem or situation. Associated with “right-brain¹” creative thinking it requires the use of both logical and lateral thinking and the suspension of the human mind’s tendency to self-censor.
- Convergent Thinking: concerned with organizing, categorizing and making sense of information and ideas. Very much logical “left-brain” thinking. It is often a destructive activity with the removal and consolidation of ideas and information.

The concept of Divergent and convergent thinking is shown pictorially in Figure 1.

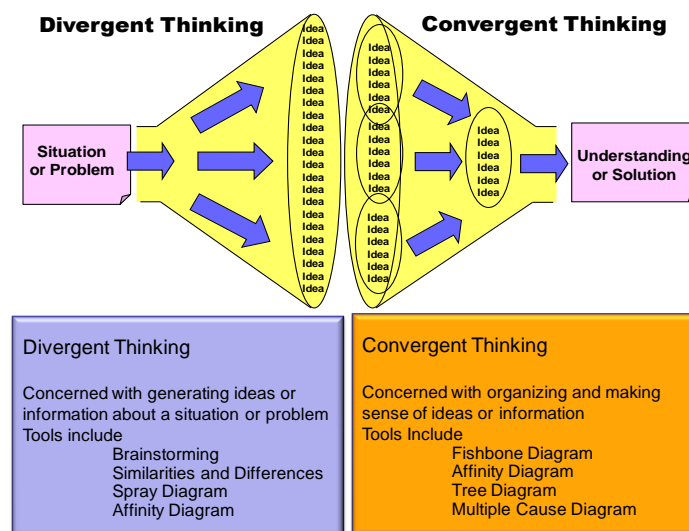


Figure 1: Divergent and Convergent Thinking

To aid the two types of thinking a number of tools are available. A Spray Diagram is one such tool that can help and individual or team carry out Divergent Thinking.

Where and when to use it?

The Spray Diagram is an alternative to brainstorming. It is particularly useful when the situation or problem is considered too complex to be handled by a simple brainstorming session. The Spray Diagram captures not only the thoughts or ideas generated by the team or individual but how the thoughts evolved. This can be highly useful in root cause analysis by subliminally “asking” the team to “dig deeper”. It is not unlike a implicit 5-Whys².

¹ Right and left-brain thinking stems from research that shows that the hemispheres of the human brain are optimised for different types of thinking. Typically, the left hand hemisphere is associated with logical thought while the right with creative imaginative thinking.

²5-whys is a classic root cause analysis tool that seeks to determine the true root cause of a problem by asking “why” repeatedly.

Who does it?

An individual or team can create a Spray Diagram. However, it is at its most powerful when used by a team. This is primarily because it is a divergent thinking tool whose purpose is to generate information about the problem or situation. It is therefore important that a team comprises members who have knowledge about the situation or problem. There is, however, no reason why this core team cannot be supplemented with additional members who have limited experience of the situation or problem. This can help ensure that “obvious” or “basic” information is not excluded; experts often mentally “self-censor” ideas which non-experts would not.

There is great benefit in terms of quality of output and time efficiency if a person who is familiar with constructing a Spray Diagram facilitates the session. If no independent facilitator is available then one person from the team will have to take responsibility for capturing the thoughts and ideas that are generated. There are two drawbacks with a member of the team capturing the thoughts and ideas:

1. The people capturing the thoughts and ideas of the other team members will not themselves be able to contribute fully to the generation of ideas. Moreover, attempting to perform two tasks simultaneously often results in neither being addressed adequately.
2. The person capturing the thoughts and ideas has the “power of the pen”! It is possible for the recording person to introduce bias into the outcome.

How to do it?

A Spray Diagram can be constructed by an individual or by a team. Indeed, on a personal note, I always use a Spray Diagram to take notes in meetings since it captures the links between items of conversation that can be useful to remember at a later date. However, in the following description it is assumed that a team has been assembled. The basic approach to generating a Spray Diagram is to use a white board (preferred) or flip chart and record, centrally, the situation of interest. This statement of the situation of interest forms the starting point of the Spray Diagram and should be thought about carefully. Ideally the statement should be defined in advance of the session. In drafting the statement of the situation of interest it is important to note that Spray diagrams can be used to generate ideas about:

- a problem
- an opportunity
- a situation (which later, following the collection of thoughts and ideas, could lead to the definition of a problem or opportunity).

The starting statement must be clear and concise.

The team now use thought association, like word association, to generate information about the situation. As each new thought or idea is expressed it should be captured on the emerging Spray Diagram with a line to indicate where that particular item came from. The use of lines is important since it subliminally causes the team to pursue a “chain of thought”. To illustrate this process consider the situation of interest “Crude Oil Price rise”. This has been captured centrally as shown in Figure 2.

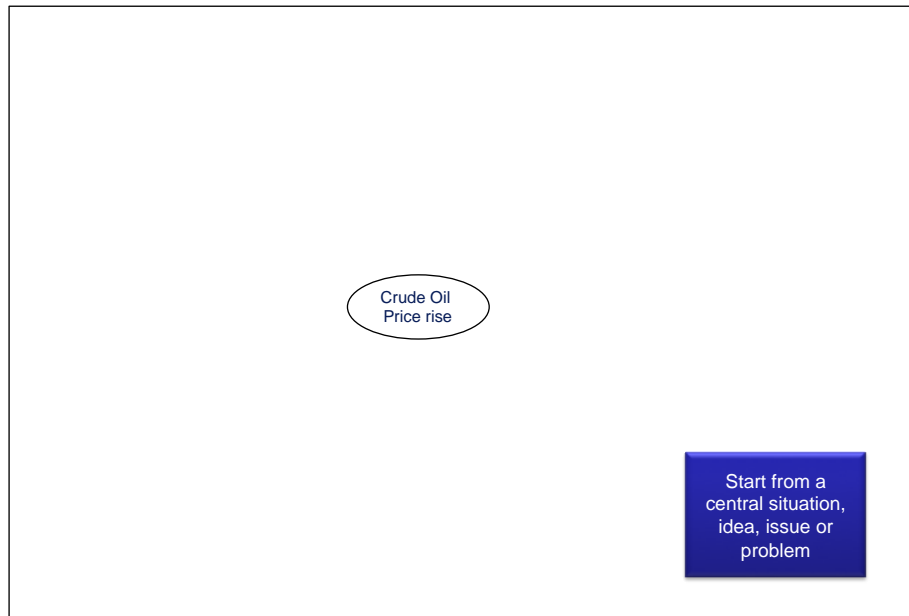


Figure 2: The starting point for a Spray Diagram to generate ideas and thoughts about “Crude Oil Price rise”

From this starting point the team are asked for thoughts and-or ideas related to “Crude oil price rise”. Figure 3 shows a likely first response.

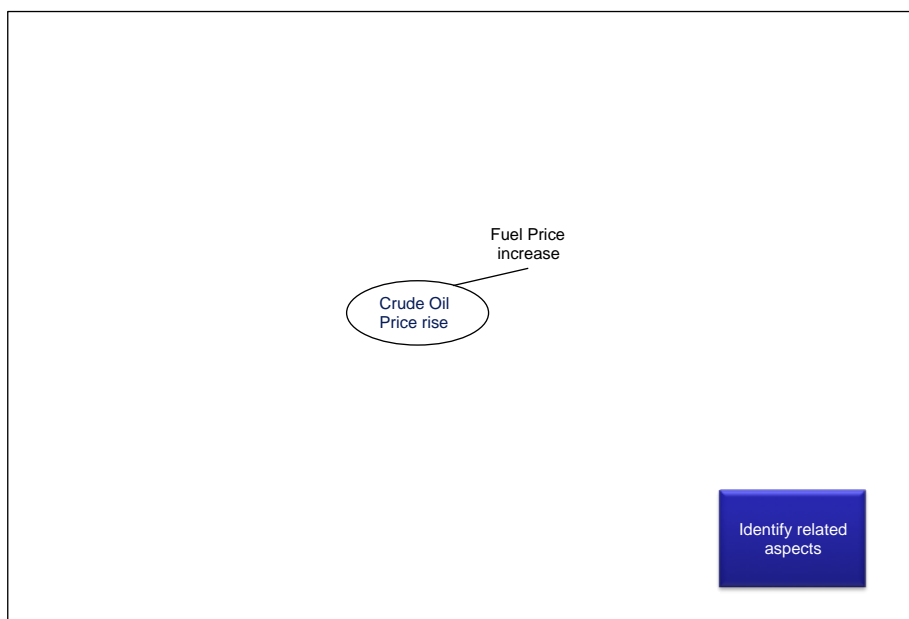


Figure 3: The first response to “Crude Oil Price rise”

It is important to note the line in Figure 3. This is stating that the “fuel price increase” came from “Crude Oil price rise”. This process is continued with a line drawn to indicate which preceding item it was derived from. Eventually there will come a point where a “chain” of thoughts comes to an end. In other words, no further thoughts or ideas stem from what has gone before. It is also possible that a thought or idea expressed by a team member may constitute a new path; it is considered sufficiently important to justify its own branch. Figure 4 shows such a chain or branch of thoughts.

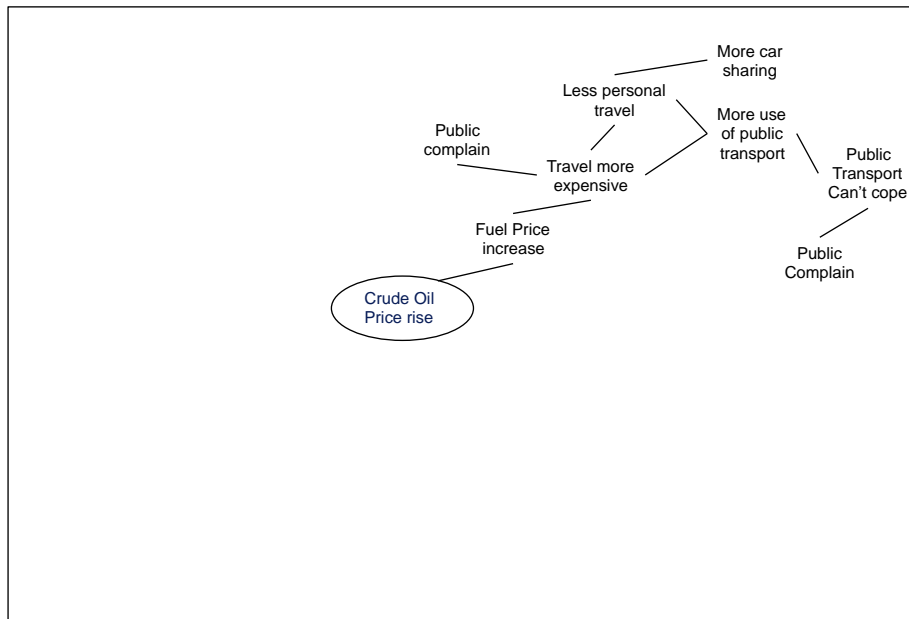


Figure 4: A “completed” branch on a Spray Diagram

Experience shows that most branches will “peter out” after a relatively short time (2 to 5 minutes). Theoretically, of course they could continue *ad infinitum*. In practice we tend to keep the central starting statement in mind and once a branch extends to five or six items (hence the link with the 5-Whys) we feel it is too “far away” from the original starting statement.

Once a branch is exhausted, the team should either search for a new one or look to see if they are any further sub-branches of earlier parts of the current branch. Figure 5 shows a new sub-branch while Figure 6 shows the start of a completely new branch.

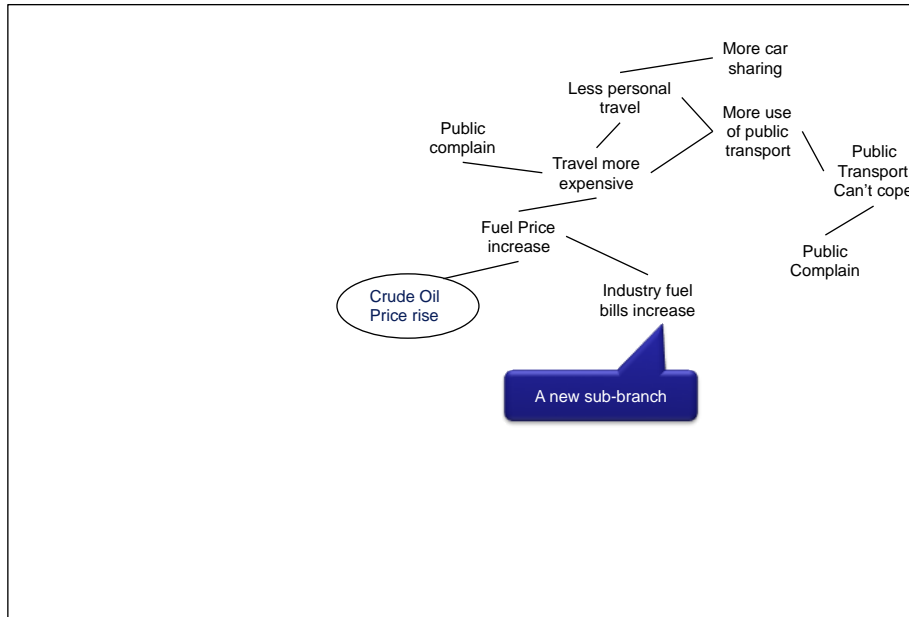


Figure 5: A New Sub-Branch

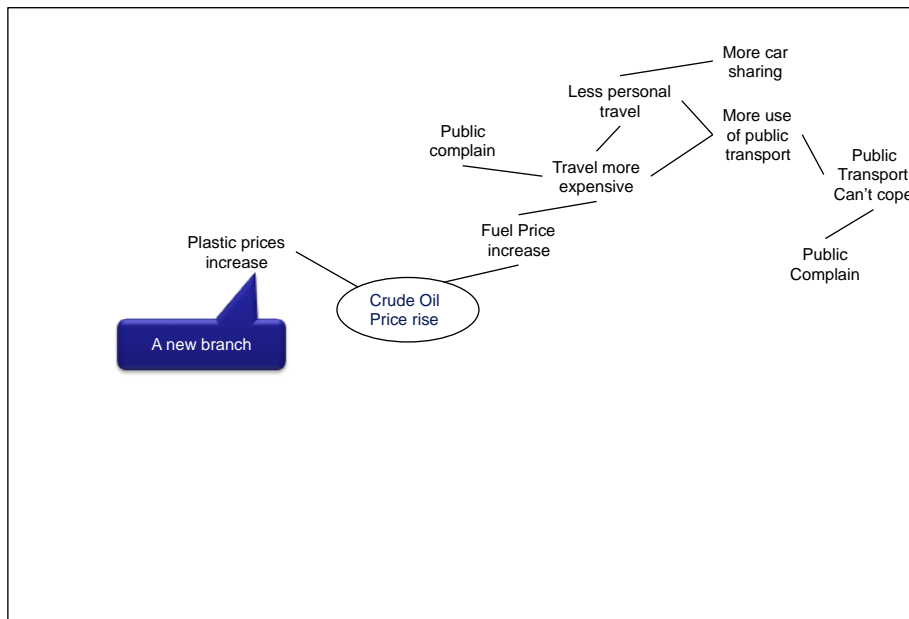


Figure 6: A New Branch

This process can be continued until the diagram is considered complete. A number of reasons can dictate this:

- Sufficient information has been gathered for the purpose of the session.
- The session is time bound – e.g. the one-hour allocated is consumed.
- The team “runs out of steam”! Divergent thinking is a tiring activity and it not uncommon for thoughts and ideas to dry up.

Figure 7 shows a “completed” Spray Diagram. The use of quote marks around completed is to indicate where this team decided to stop and therefore as an activity the Spray Diagram is complete. However, on examination there will always be potential additions. One of the key benefits of a Spray Diagram over a conventional “brainstormed” list, is that they are easy to review and refine by others who were not involved in the original construction.

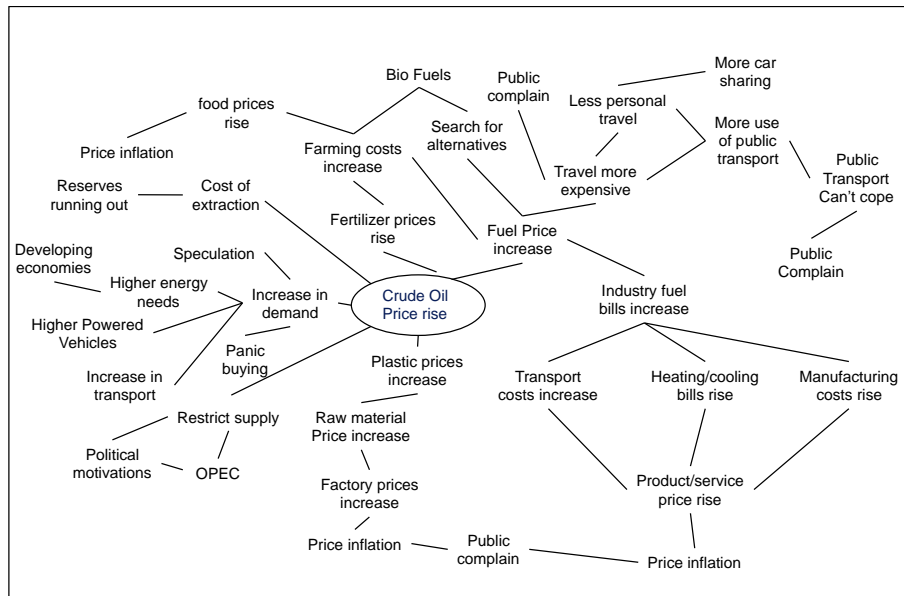


Figure 7: A “Completed” Spray Diagram.

There are several points to note about Figure 7.

- Some thoughts and ideas contribute positively some negatively.
- Some thoughts and ideas are repeated.
- Some links appear logical.
- Some links require a mental leap.
- There doesn't have to be a logical link between elements on a path.
- Spray diagrams are about generating information rather than organizing it – quantity not quality.

It is perhaps also important to compare a Spray Diagram with its more ubiquitous brother “Brainstorming”. To all intents and purposes, both tools are concerned with divergent thinking, but the Spray Diagram offers several advantages:

- By following a branch, a thought chain is taken much further than in a brainstorming session where idea generation is more random. The advantage is that it encourages the team to be more holistic.
- The inclusion of the links to show the evolution of the diagram can help organize thoughts and identify potential causal chains. This can significantly help in constructing Multiple Cause Diagrams or Causal Loop Diagrams.

- Brainstorms are list based and therefore encourage linear thinking, whereas Spray Diagrams can capture more complex relationship and promote Systems Thinking.
- Spray Diagrams are easier to review.

Spray Diagrams do, however, have disadvantages, that should never be overlooked:

- The combination of both logical and illogical (lateral) links can make the diagrams more difficult to interpret.
- Pursuing a branch can negate the “random” quality of a conventional brainstorm.

What Goes Wrong: The limitations of a Spray Diagram

Constructing a Spray Diagram is a very simple but powerful tool for generating, capturing and organizing ideas and information about a problem or situation. It does however have limitations and can be awkward to use. Some of the issues with its use are given below with advice on avoiding, and recovering from, the problem.

- Individuals dominating the team. If the group is hierarchical consider using a facilitator or limit the number of people involved in the team.
- The “power of the pen”. The person nominated to capture the thoughts and ideas is in a very powerful position to bias the team’s thoughts by modifying what was expressed or even ignoring it. Again, a facilitator can remove this problem.
- Searching for logical thoughts and ideas only. Following a branch does encourage the team to look for logical related thoughts and ideas. This can be overcome with a facilitator or by initially asking for ideas to start off the main branches and then consider each in turn.
- Output format not intuitive to novice reader. Completed Spray Diagrams are not immediately intuitive to a person who has not seen one before because of the mix of logical and illogical links. The diagram should be explained, if included in another document.

Bibliography

Spray Diagrams were invented by Tony Buzan and despite their obvious power and simplicity of use there is little published about them. There is some confusion between Spray Diagrams and Tony's other great invention "the Mind Map". They are similar but different.

Buzan Tony "Use Your Head" January 1974 [ISBN 0-563-10790-1](#)