Difference between Artistic and Scientific Creativity

- **Scientific discovery – Confirmations**
- **Artistic Creativity – Replication**
-
- **Exercise**

Imagine yourself listening to a piece of music that you enjoy and that moves you. Does it evoke personal memories or do you like it simply for what it is.

- **Two Facts**

Two conditions

- **Every scientific or technological solution , any discovery or innovative product, is creative in respect to another which is less creative.**
- **A work of art that produces pleasure, joy, happiness(or any other emotion) recreates the emotions again and again**

What is Opposite of Creativity

- **Academic? Repetitive? Cloned? Imitative? Derivative? Out-dated? Predictable? Traditional? Boring? Common? Weak….**
- **Is freedom a constituent of creativity?**
- **Mathematics is creative?**
- **Structured . Made up by postulates, axioms, rules and procedures.**
- **In order to be creative , one must be free to choose.**

Thus

- **Too many standards and reference frames for creativity**
- **Single invariant is : In order for something (object, action, process) to be defined creative, it must be a product of a free act and not of a deterministic process(research is creative?)**

Introduction of subjectivity in objectivity observation

Diary keeping for methodology leading to practice of thesis writing

What is Important

- **Psychological process of creativity or the history of the process.**
- **Science interrogate but creativity answers!**

I do not search, I find

Picasso

Technological Advances: discovery, Invention, Innovation, Diffusion, Research and Development

Technology is the single greatest factor that distinguishes modern economies from primitive ones. Because technology lowers the cost of production and provides new products, it increases both productive and allocative efficiency for all firms. However, technology is unpredictable. No one knows what will be discovered where or when. Indeed, it is very difficult even to measure the pace of new technology.

For this reason, technology is often excluded from economic models to simplify their analysis. In economics, the **short run** is considered a period time during which firms can change variable inputs but not fixed costs. The **long-run** is considered a long enough time period so that firms can change even fixed costs. Some economists try to take a **very long run** view in which technology changes, but it is very difficult to form such an analysis, even using statistics. Although it is called a very long run view, the time period could actually be short, depending on how fast technology is changing within an industry.

There are 4 processes to technological advances in an economy: discovery, invention, innovation, and diffusion. **Discovery** involves the elucidation of the fundamental processes of nature through observations of nature, reasoning, and experimentation. Science is the branch of knowledge that seeks to understand the fundamental nature and processes of the universe. Indeed, advances in science involve what is called the **scientific method**, first, a hypothesis is formed to explain some observation, then an experiment is designed to test the hypothesis. When feasible, the experiment will consist of running 2 experiments side-by-side with all variables in common except for one. This isolates the variable to determine what effect it has on the overall process. Ultimately, the validity of the hypothesis is determined by the reproducibility of the experiment and how well it coheres with previous knowledge. When there is significant confidence in the correctness of a hypothesis, then it is often referred to as a **theory**. Of course, economics is one of the sciences where testing hypotheses is not feasible in most cases, so most advances in economics are made by assessing how well hypotheses explain or predict the economy. Although discoveries are important for providing the fundamentals of knowledge, most businesses do not invest money to make discoveries because discoveries are often serendipitous and they rarely apply to a particular business, which is why a large part of science is financed by the government. Instead, businesses spend money on **research and development** (R&D), applying previous knowledge to either produce new products relevant to their business or to improve methods of doing their business, where results are more predictable and more pertinent. Moreover, most governments allow the business to patent the new product or process as an invention.

Invention is the discovery or development of a product or process by applying previous knowledge in new ways. Inventions often begin as **prototypes**, in which the essential features are developed to see if they are workable. These prototypes, or **basic working models**, are then improved by adding, subtracting, or modifying the characteristics of the prototype until no other improvements can be made based on the prototype.

To motivate people to invent, governments generally grant **patents**, which gives the patent holder exclusive rights to sell the patented product or method for a specific

period of time. Most patents have a duration of 20 years from the filing of the patent application.

Innovation is applying basic discoveries or inventions to produce a useful product or process for a specific application. **Product innovation** is the development of new and improved products or services; **process innovation** refers to new or improved methods of production or distribution. Innovations cannot be patented, even though often times the distinction between inventions and innovations is blurry.

Discoveries and inventions are rarely profitable in themselves. Innovation is necessary to bring the product to market economically. For instance, the development of integrated circuits has been one the most important in history, enabling modern-day computers, tablets, and phones. In fact, integrated circuits are necessary for almost all electronic devices. However, there are 2 steps in developing new integrated circuits. The first step is that they must be designed so that they work in a specific way diverting the flow of electricity so that the device can carry out its purpose. Once the integrated circuit chip is designed, then the company would have to also develop an economic way of manufacturing the chips, for without a low-cost method of manufacturing the chips, their prevalence, and therefore their influence, would be limited. Hence, their decreasing cost over time is almost as important as their actual design.

Diffusion is the spread of innovation to other firms so that they can remain competitive. This diffusion occurs by either emulating or copying others' products or processes, which is achieved in several ways. First, a company can look at any patents, which are available for inspection by anyone, to see the essential design, and develop new ways of working around that, developing ideas or methods to achieve the same functionality but without infringing the patent. Since patents are narrow in scope, a patent may reveal ways around it, enabling a competitor to develop a process or product that is functionally equivalent to the patented product or process. In other cases, competing firms can reverse engineer the product to see how it works and to see how it could be improved.

Website development is a good example of diffusion. For instance, Groupon developed a new way for firms to market their products and services by selling what is known as a group coupon over the Internet, which gives the consumers a steep discount if enough of them subscribe to the product or service. Now, many other companies have also started offering major deals, many of them offering variations of the group coupon.

Businesses engage in research and development to develop inventions, innovations, and to profit from diffusion. However, firms generally do not invest research efforts to find new discoveries, because they cannot be patented nor do they necessarily have an obvious business application, making it unlikely that a discovered process can be used to develop a new product or new process that would allow the firm to earn more profit. For this reason, governments generally subsidized basic research.

(http://thismatter.com/economics/technological-advances.htm)

LATERAL THINKING SKILLS

Innovation distinguishes between a leader and a follower.

Creativity is just connecting things. When you ask creative people how they did something, they feel a little guilty because they didn't really do it, they just saw something. It seemed obvious to them after a while. That's because they were able to connect experiences they've had and synthesise new things.

Steve Jobs

Lateral thinking, is the ability to think creatively, or "outside the box" as it is sometimes referred to in business, to use your inspiration and imagination to solve problems by looking at them from unexpected perspectives. Lateral thinking involves discarding the obvious, leaving behind traditional modes of thought, and throwing away preconceptions.

It's very **important in careers such as advertising, marketing, the media and art and design** where you may get questions in the selection process along the lines of "Write down one hundred ways to use a brick/paperclip", but it can also be of value in the jobhunting process itself.

Lateral thinking in the jobhunting process

A number of graduates have tried the old and hackneyed methods of trying to gain the selector's attention, such as enclosing a tea bag with their application, so that the selector could take a break to have a cup of tea before reading it. Others have send their CV to newspapers in a magazine format, but below are a couple of truly original approaches:

A graduate had been trying to get into **investment banking**, but without success and had exhausted all the normal routes. As a last resort, he had 100 postcard-sized CVs printed. He then went round the "Square Mile" in the City, where all the main financial organisations in London are located and proceeded to place one of these CVs under the windscreen of every Rolls Royce and top of the range BMW and Mercedes he came across. Next day, he had several 'phone calls offering him interviews from the senior executives whom the cars belonged to. Note that we are not advocating this approach: one graduate jobseeker put up 200 poster sized CVs around Hull and ended up being fined for bill posting!

A student wanted to become a trainee **journalist** on her local newspaper. She decided to carefully analyse the content of the paper and compared it with similar local papers. She conducted a small survey of readers' opinions on the paper by interviewing passers-by in the city centre. Using this information, she drew up a list of possible changes to the paper, wrote a sample article to show what she had in mind and sent these to the editor. The editor invited her in to

discuss her suggestions - they had a long discussion and the next vacancy that arose was offered to her without competition.

One New York graduate who wished to work in a top **advertising agency** Googled the names of the creative directors of these agencies and then spent just six dollars on a set of Google ads that were triggered when the directors searched for their own names. The adverts said *"Hey, (creative directors name), Googling yourself is a lot of fun. Hiring me is fun, too"* Of the five directors he targeted, four gave him an interview and two offered him a job
www.youtube.com/watch?v=7FRwCs99DWg

The chocolate bar CV. A job hunter made his CV as the wrapper for a chocolate bar. It turned out to be very popular with recruiters! www.cnbc.com/id/100482311

Creative thinking is not a talent, it is a skill that can be learnt.

Edward de Bono

Intelligence is something we are born with. Thinking is a skill that must be learned.

Edward de Bono

If they give you ruled paper, write the other way.

Juan Ramón Jiménez

If people aren't calling you crazy, you aren't thinking big enough.

Richard Branson

Lateral Thinking Quiz

The following questions will test your ability to think laterally. If you get more than 50% of these right you're certainly strong on your lateral thinking skills (or maybe you're just good at quizzes!)

1. A graduate applying for pilot training with a major airline was asked what he would do if, after a long-haul flight to Sydney, he met the captain wearing a dress in the hotel bar.
   What would you do?
2. A man built a rectangular house, each side having a southern view. He spotted a bear. What colour was the bear?
3. If you were alone in a deserted house at night, and there was an oil lamp, a candle and firewood and you only have one match, which would you light first?
4. What can you put in a wooden box that would make it lighter? The more of them you put in the lighter it becomes, yet the box stays empty.
5. Which side of a cat contains the most hair?
6. The 60th and 62nd British Prime Ministers of the UK had the same mother and father, but were not brothers. How do you account for this?
7. How many birthdays does a typical woman have?

Jackie Stewart, three times World Champion Formula One racing driver had undiagnosed dyslexia and was unable to complete his school education. He said: *"When you've got dyslexia and you find something you're good at, you put more into it than anyone else; you can't think the way of the clever folk, so you're always thinking out of the box."*

8. Why can't a man living in Canterbury be buried west of the River Stour?
9. Is it legal for a man to marry his widow's sister?
10. If you drove a coach leaving Canterbury with 35 passengers, dropped off 6 and picked up 2 at Faversham, picked up 9 more at Sittingbourne, dropped off 3 at Chatham, and then drove on to arrive in London 40 minutes later, what colour are the driver's eyes?
11. A woman lives on the tenth floor of a block of flats. Every morning she takes the lift down to the ground floor and goes to work. In the evening, she gets into the lift, and, if there is someone else in the lift she goes back to her floor directly. Otherwise, she goes to the eighth floor and walks up two flights of stairs to her flat. How do you explain this?
12. A window cleaner is cleaning the windows on the 25th floor of a skyscraper, when he slips and falls. He is not wearing a safety harness and nothing slows his fall, yet he suffered no injuries. Explain.
13. The band of stars across the night sky is called the "..... Way"?
14. Yogurt is made from fermented .....
15. What do cows drink?

"The fear of making a mistake, of risking an error, or of being told you are wrong is constantly with us. And that's a shame. Making mistakes is not the same thing as being creative, but if you are not willing to make mistakes, then it is impossible to be truly creative. I f your state of mind is coming from a place of fear and risk avoidance, then you will always settle for the safe solutions—the solutions already applied many times before.

Failing is fine, necessary in fact. But avoiding experimentation or risk—especially out of fear of what others may think—is something that will gnaw at your gut more than any ephemeral failure. A failure is in the past. It's done and over. In fact, it doesn't exist. But worrying about "what might be if…" or "what might have been if I had… " are pieces of baggage you carry around daily. They're heavy, and they'll kill your creative spirit. Take chances and stretch yourself. You're only here on this planet once, and for a very short time at that. Why not just see how gifted you are?"

Daniel Garr - Presentation Zen

I once visited a major pharmaceutical company to discuss their graduate recruitment for marketing. They told me that one of the key attributes they looked for was **Helicopter Ability**: the ability to soar above a problem and to see all aspects of it, to stand back and see the bigger picture, the wood rather than the trees. Creativity involves being able to think outside the box to find solutions to unpredictable

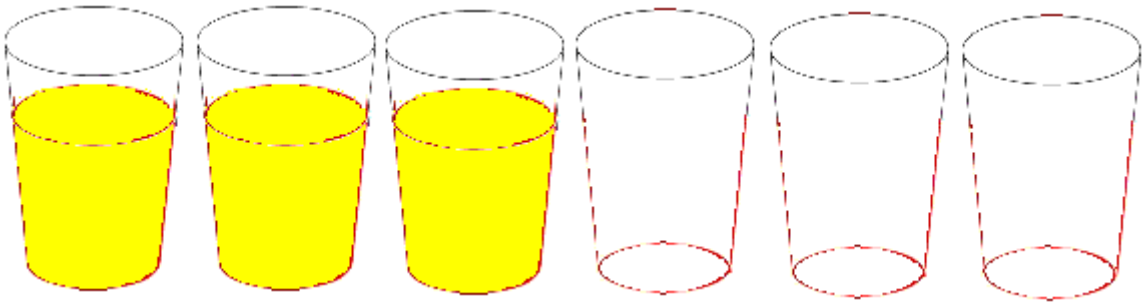
16. The Zorganian Republic has some very strange customs. Couples only wish to have female children as only females can inherit the family's wealth, so if they have a male child they keep having more children until they have a girl. If they have a girl, they stop having children. What is the ratio of girls to boys in Zorgania?

problems. This needs logic and analysis, but also the ability to see the big-picture and this involves a creative mind.

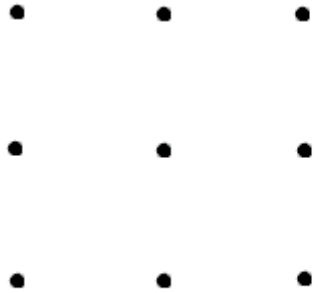
17. How many hands does the clock of the tower of Big Ben have?
18. John's mother has 3 children, one is named April, one is named May. What is the third one named?
19. You are running in a race. You overtake the second person. What position are you in?
20. In the same race, if you overtake the last person, then you are in what position?

21. Using just ONE straight cut, how can you cut a rectangular cake into two equal parts when a rectangular piece has already been removed from it?
22. A man and his son were in a car crash. The father was killed and the son was taken to hospital with serious injuries. The examining doctor exclaims: "But, this is my son!".
    How can this be?
23. You have to choose between three rooms.
    The first is full of raging fires
    The second is full of tigers that haven't eaten in 3 years.
    The third is full of assassins with loaded machine guns.
    Which room should you choose?

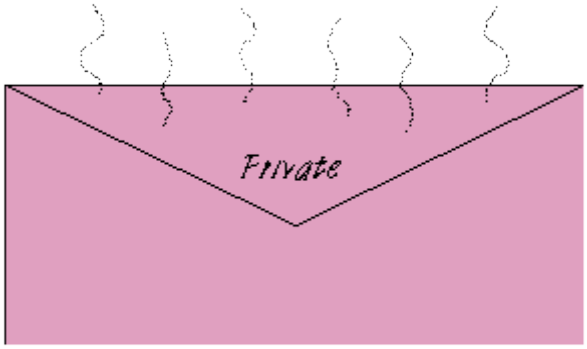
24. Three of the glasses below are filled with orange juice and the other three are empty. By moving just one glass, can you arrange the glasses so that the full and empty glasses alternate?



25. Name three consecutive days in English without using the words Tuesday, Thursday, or Saturday
26. What's unusual about this paragraph? Just how quickly you can find out what is so funny about it. It looks fairly ordinary and plain that you might think nothing is wrong with it. In fact, nothing is wrong with it! It is highly curious though. Study it and think about it, but you still may not find anything odd. But if you work at it a bit, you could just find out.



27. Join all the 9 dots on the right using four straight lines or less, without lifting your pen and without tracing the same line more than once. Do copy this onto paper if you wish to make it easier.



*One student, desperate to get into **advertising**, had been rejected by the main London agencies, so he decided to try a different approach. He bought some pink envelopes and a small bottle of expensive perfume. He placed his CV in the envelopes and wrote "Private" on the outside. He liberally sprinkled the envelopes with scent and posted them to the senior agency partner in several of the biggest agencies. When it arrived, nobody dared to open the letters and the graduate was offered several interviews - presumably for his daring. Note that, we don't recommend this approach!*

Answers:

1. Offer to buy her a drink! The captain was of course a woman. Many airlines are now hot on equal opportunities and a candidate who had difficulty envisaging that an airline captain might be female would not go very far!
2. White. Only at the North Pole can all four walls be facing South.
3. The match!
4. Holes
5. The outside
6. Churchill was Prime Minister twice, from 1940 to 45 and from 1951 to 55.
7. One
8. Because he is still alive .
9. No - because he's dead.
10. The colour of your eyes.
11. The woman is of small stature and couldn't reach the upper lift buttons.
12. He was cleaning the inside of the windows.
13. Milky Way
14. Milk
15. Water. After the previous two questions, did you answer milk?
16. About 1 to 1. Any birth will always have a 50% chance of being male or female.

Most of the above are what we call "Insight puzzles". Research by Schooler and Melcher (University of California) found that **people who wrote down the puzzles and tried to solve them on paper were on average 30% less likely to come up with the right solution** than those who didn't write it down and just solved them in their heads.

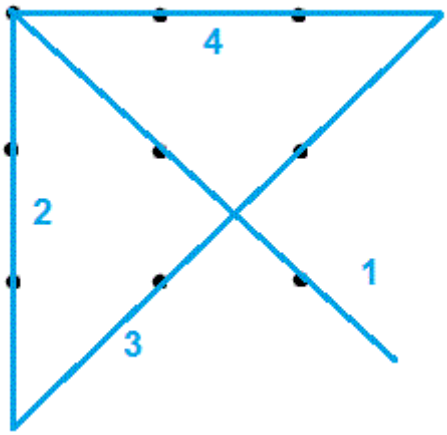
Writing down the puzzles invokes the use of the left side of our brain which deals with verbal and logical (algorithmic) reasoning, rather than the right side which deals with visual and creative (heuristic) thinking.

These puzzles tend to require creative rather than logical reasoning to solve them, so we need to use right brain thinking.

17. Eight: there are four faces to the clock of the tower of Big Ben (now officially called Elizabeth Tower). See the picture to the right.
18. John
19. If you overtake the second person then you become second.
20. You can't overtake the last person in a race!
21. Cut it horizontally half way up (i.e. parallel to the top) . See right.

Alternative answer provided by a reader of this page: the above answer in not the only correct answer, in fact, there are infinitely many correct answers. One of these correct answers is this: find the center of the cut portion of the cake (which is the point of intersection of the two diagonals) and also the center of the original cake (which, again, is the point of intersection of the two diagonals). Now a straight vertical cut along the centers will cut the remaining cake into two equal parts. This solution is perhaps better than the one above for the following reason: quite often the upper part of a cake is not the same as the lower part, as they contain different ingredients. For example, the upper part may have frosting, unlike the lower part. My solution above 'guarantees' not only equal volumes, but also equal ingredients.

22. The doctor was his mother. Going full circle, this is very similar to the first question.
23. The second room. Tigers that haven't eaten in three years are dead!
24. Pour the juice from the second glass into the fifth.
25. Yesterday, today, and tomorrow.
26. The letter e doesn't appear once in the paragraph.
27. Here is one possible solution. Of course you have to go beyond the boundaries of the square of dots to solve this.



Out of interest this particular puzzle is where the expression *"to think outside the box*" originally came from.

Score

- **Over 23.** You are a true lateral thinking Guru. Edward De Bono would be proud of you. Or maybe you are the man himself.
- **20 to 23.** Very good.
- **Under 12** - watch The Matrix, The Simpsons and Dr Who a few more times!

Critical Thinking Vs Creative Thinking

Critical thinking is the active, persistent, and careful consideration of beliefs or knowledge in light of evidence, and creative thinking is the generation of new ideas. Critical and creative thinking are fundamental to human intellectual progress and artifacts thereof. Depending on context and purpose, critical and creative thinking skills can be interdependent or separately applied.

Critical thinking is the active, persistent, and careful consideration of a belief or form of knowledge, the grounds that support it, and the conclusions that follow. It involves analyzing and evaluating one's own thinking and that of others. In the context of college teaching and learning, critical thinking deliberately and actively engages students in:

- Raising vital questions and problems and formulating these clearly and precisely;
- Gathering and assessing relevant information, and using abstract ideas to interpret it effectively;
- Reaching well-reasoned conclusions and solutions and testing them against relevant criteria and standards;
- Openly considering alternative systems of thought; and
- Effectively communicating to others the analysis of and proposed solutions to complex challenges.

Creative thinking is the generation of new ideas within or across domains of knowledge, drawing upon or intentionally breaking with established symbolic rules and procedures. It usually involves the behaviors of preparation, incubation, insight, evaluation, elaboration, and communication. In the context of college teaching and learning, creative thinking deliberately and actively engages students in:

- Bringing together existing ideas into new configurations;
- Developing new properties or possibilities for something that already exists; and
- Discovering or imagining something entirely new.

Critical Thinking	Creative Thinking
analytic	generative
convergent	divergent
vertical	lateral
probability	possibility
judgment	suspended judgment
focused	diffuse
objective	subjective
answer	an answer
left brain	right brain
verbal	visual
linear	associative
reasoning	richness, novelty
yes but	yes and

(Definitions adapted from John Dewey; Richard Paul and Lind Elder; Mihaly Csikszentmihalyi, and M.A. Rosenman and J. S. Gero.)

Tools For Creative Thinking

IMPLEMENTATION PROCEDURE

As mentioned before, there is numerous creativity supporting techniques. The description, in an illustrative manner, of some well-known creative techniques for problem solving will be presented here. See also Annex, Table 1, the use of some stimulus that can extend perspectives to approach a problem.

Brainstorming

This is one of the best known and most used in the business world group based creativity process for problem solving. It is a method of getting a large number of ideas from a group of people in a short time. It can be used for generating a large number of ideas or solutions for well-defined strategic or operational problems, such as for engineering design processes. It forms also a basic framework or constitutes the initial phase for the implementation of many other groups based on creative techniques.

Brainstorming sessions take place in a group of 6-10 people. The presence of a leader is necessary to stimulate the generation of ideas, as well as a preparation phase to gather the necessary data and information to approach the problem. A

recorder writes the problem statement and the idea generated by the group on a white board. Several guidelines for brainstorming are available, such as suspend judgement, free wheel, quantity, and cross-fertilise. The whole process takes normally one hour and can be conducted through several stages. The session begins with stating the problem and calling for solutions by the leader. The following stages can be: restate the problem in the form of "How to…", select a basic restatement and write it down as "In how many ways can we…", warm-up session, brainstorming, and identify wildest idea. An evaluation method is additionally used for to identify the ideas that have a value for implementation. The four basic rules of brainstorming are: a) no criticism and no prior judgement of any idea, b) all ideas,even the absurd, are welcome, c) quantity has value, the more ideas the better, if a large quantity of ideas is generated, then the idea pool very likely would contain high-quality ideas, d) sharing and combining ideas, and constructing ideas based on those developed by other members of the group for producing new ideas. See: Osborne (1963), Rawlinson (1981), Chen (1998), Higgins (1996), European Commission (1998). See also Annex, Table 2: Brainstorming phases.

A special type of brainstorming tool is PMI in which the participants are directed to brainstorm the Plus points, then the Minus points and finally the Interesting points (De Bono 1992, 1993).

Related to brainstorming, which is characterised by verbal communication, is also the hand-written communication as a brain-writing technique. The process is that ideas generated by individuals are written down on a piece of paper, and then exchanged and combined with those of the other individuals in the group. Written ideas are circulated and read by the other participants in the group each of whom, in turn, write down new ideas. A variation of this hand-written communication is the 6-3-5 method in which each of the 6 participants in the group generates and writes 3 ideas related to the problem on a piece of paper in 5 minutes. After 5 minutes, each participant passes the piece of paper to the person on the right, who reads it and adds 3 new ideas in 5 minutes. The process continues until each participant gets the original piece of paper back (European Commission 1998).

Electronic brainstorming is also a hand-written communication technique, which employ computerised programs to achieve brainstorming.

Story boarding

It is a creativity technique for strategic and scenario planning based on brainstorming and used mainly by groups. It requires a leader, a secretary and takes place in a group of 8-12 people. The leader arranges the ideas generated by brainstorming in a logical order on a white board creating a story. This technique allows identify the interconnections of ideas and how all the pieces fit together.

It can be used to identify issues, problems, solve a complex problem and determine ways to implement solutions.

The story boarding process includes four phases: a) planning, b) ideas, c) organisation and d) communication. Each phase includes a creative session (it takes 45 minutes) and a critical session, in which participants critique their story board.

- The planning phase begins with the problem definition or the issue being examined - the topic header. Purpose header, a miscellaneous column and other, normally 10-12, headers (column titles) are placed and brainstormed in order to give Ideas and then items, which are listed under the headers (the purpose header is listed first).

- The second phase - the ideas board, is to take one column from the planning board, which becomes the topic header and the items of that column become headers of new ideas.

- In the third phase - the organisation board, participants identify who is responsible for implementing chosen solutions, what has to happen, and when.

- In the last phase - the communication board, participants identify who must communicate with for all of the events identified in the organisation board to take place. Through the process, visual graphics to summarise or present relevant points are presented by the leader. These might be strategic models, places or things (Higgins 1996).

Lotus Blossom

This technique can also be used in scenario planning and is very useful for forecasting strategic scenarios. It is designed for groups and is used to provide a more in-depth look at various solutions to problems. It begins with a central core idea surrounded by eight empty boxes or circles. Using brainstorming, eight additional ideas (solutions or issues) are written in these boxes. In the next step, each of these eight ideas becomes the core of another set of eight surrounding empty boxes, which are filled in by new ideas using brainstorming. The process continues until a satisfactory solution or a sufficient number of ideas have emerged (Higgins 1996). See Annex, Figure 1: Lotus blossom sample.

Checklists

This creative technique is used mainly for product improvement or modification. It involves applying a series of words, verbs, adjectives or phrases contained in checklists or tables to an existing product or service or its attributes. Osborn's Checklist is the best known and includes the verbs: put to other uses, adapt, modify, magnify, minify, substitute, rearrange, reverse and combine. Each verb contains also an expanded definition in the form of questions. For example, the description of the verb substitute is: Who else instead? What else instead? Other ingredient? Other material? Other process? Other power? Other place? Other approach? Other tone of voice? (Osborn 1963). The method is to apply each of

the verbs and its expanded description to a product or service. See Annex:, Table 3: Osborn's checklist).

Another checklist technique is Van Gundy's PICL (product improvement checklist). Used in the same way as Osborn's list, gives many options containing 792 words, both standard and unique, that can be applied to existing products or services, and 102 stimulation questions (Van Gundy 1988, 1993).

Morphological Analysis

This method is another product improvement technique, permitting the in - depth analysis of products or processes. It involves applying a set of words to an item another set of words. Normally, one set of words is verbs and the other set are attributes of the product. Another way is that one set of words would be components of the product (breaking the product down into its parts) and the other set of words would be alternative solutions. The method is to combine each word of one set with each word of the other set. These two sets of words result in a two-dimensional matrix. A three dimensional matrix can be created by adding a third list of factors. The difficulty of this technique is the large number of ideas deriving of the multiple combinations that can be made (Higgins 1996, European Commission 1998).

Mapping Process

The use of maps is particularly useful in strategic management thinking in organisations, helping to organise discontinuities, contradictions or differences, and bring pattern, order and sense to a confusing situation, acting as a spatial representation of a perspective. There are many forms of mapping, including computer-based tools to support mapping:

- Mind Mapping

It is an individual brainstorming mapping technique designed by Tony Buzan. It begins with a central focal point, a problem, an object, a name or issue, written in the centre of a piece of paper with a circle around it. Each major facet of the problem or the solution to the problem originating from the central idea is then brainstorming in order to generate new ideas. Each of those ideas are then written on lines drowned outward from the circle. The next step is to brainstorm those ideas in order to identify issues related to the problem, or solutions that are written on smaller lines that are drowned on the prime lines forming a branch. Additional perspectives such as implementation factors or further definition of the solutions could go on those lines. One branch may also be chosen in order to develop a whole new mind map based on that branch. When a mind map is completed, its possible interrelations and possible multiple appearances of issues, and its overall meaning in the context of the problem must be examined (Buzan 1983).

- Mapping for generate collective creativity

The use of maps to support collective creativity is a more complicate process. It is necessary to introduce appropriate maps into a suitable type of organisation that would preferably be one employing multidisciplinary teams. It is also important that the participants find the maps useful for organising and planning their work. The mapping process usually involves three phases:

1st phase starts with a brainstorming exercise in order to initiate a discussion around the problem or the product. Normally, the participants are asked to mention all aspects they regard as relevant to the problem to be dealt with. During this process a large number of visual references are used to elicit the perspectives of the members with regard to the potential new concept. It is emphasised to the participants that the maps are intended to enrich the conversation, and should not be perceived as representations of the concept itself, but more as the semantic terrain or space, which covers all potential strategies. The knowledge elicited is discussed, and in about 2 hours is organised and structured by the participants into a map that intuitively understand. This map is the initial cognitive map, which describes all the problematic areas in brief outlines.

In the 2nd phase of the process, which serves to expose the individual participants' perspective both to themselves and to the other members of the group, the participants discuss the values that they associate with a very large range of objects and images. A number of these images are then selected that are considered to metaphorically represent potential aspects of the product strategy.

In the 3rd phase, these images and appropriate annotations are arranged in a two-dimensional space, positioning the images depending upon how the values of these objects relate to one another. In doing this, the group is mapping out a terrain constituted by the differences between the images, expressing the range of different product strategies open to the group (Fentem, Dumas & McDonnell 1998). For creating maps, many software applications are available (see further down in computer-based creativity techniques).

Table 1: Stimulus to extend perspectives to approach a problem

• List the elements that would bring on success. • List the elements that we visualise as failure. • Visualise success seen from the viewpoint of fifty years from now. • Visualise success seen from the perspective of one hundred years ago. • Look for impossible and desirable ideas.

- Create analogies with other things that have been successful.
- Imagine and write down ideas that are wild, illegal, crazy, etc.
- Insert the problem from its present scenario to a totally different scenario.
- Return from the fantasy scenario to the present scenario and try to associate the ideas generated in the fantasy scenario, with ideas that might apply to the real problem.
- Imagine what people we admire would say.
- Search for pairs of ideas that are apparently unconnected and that can be associated by a third.
- Imagine that everything exists and all we have to do is find it.
- Change the level on which the problem is approached.

Source: European Commission, *Innovation Management Techniques in Operation*, European Commission, DG XIII, Luxembourg, 1998.

Table 2: Brainstorming Phases

Phase	Application
Orientation	Define the problem to be studied for the participants, clarify the rules of the game.
Preparation	Gather data and information necessary to approach the problem in an efficient manner.
Warm-up	Carry -out the exercise: redefine a problem different from the one to be studied, experiment with it for a few minutes.
Production of ideas	Generate the maximum of ideas without prior judgement - always ask "what else" - quantity of ideas is quality - no limits - no criticise - modify other's ideas to produce new ones.
Incubation	Let the subconscious work.
Syntheses	Gather the ideas generated - analyse them - work with logical thinking.
Evaluation	Evaluate the ideas gathered and analysed - develop and combine them before proceeding to put them in practice.

Source: European Commission, *Innovation Management Techniques in Operation*, European Commission, DG XIII, Luxembourg, 1998.

Table 3: Osborn's Checklist

Question	Description
Put to other uses?	New ways to use as is? Other uses if modified?
Adapt?	What else is like this? What other idea does this suggest? Does past offer parallel? What could I copy? Whom could I emulate?
Modify?	New twist? Change meaning, colour, motion, sound, odour, form, shape? Other changes?
Magnify?	What to add? More time? Greater frequency? Stronger? Higher? Longer? Thicker? Extra value? Plus ingredient? Duplicate? Multiply? Exaggerate?
Minify?	What to subtract? Smaller? Condensed? Miniature? Lower? Shorter? Lighter? Omit? Streamline? Split up? Understate?
Substitute?	Who else instead? What else instead? Other ingredient? Other Material? Other process? Other power? Other place? Other approach? Other tone of voice?
Rearrange?	Interchange components? Other pattern? Other layout? Other sequence? Transpose cause and effect? Change pace? Change schedule?
Reverse?	Transpose positive and negative? How about opposites? Turn it backward? Turn it upside down? Reverse role? Change shoes? Turn tables? Turn other cheek?
Combine?	How about a blend, an alloy, an assortment, an ensemble? Combine units? Combine purposes? Combine appeals? Combine ideas?

Source: J.M. Higgins, "Innovate or evaporate: creative techniques for strategists", *Long Range Planning*, Vol. 29, No 3, pp. 370-380, 1996 (reprinted from Alex Osborn, *Applied Imagination*, Charles Scribner's & Sons, Inc., New York).

Figure 1: Lotus blossom sample

1 by packaging	2 by design	3 other uses						
4 smaller / bigger	A product differentiation	5 plus ingredient		B		C		
6 other material	7 change color	8 change meaning						
			A product differentiation	B product quality	C customer needs			
	D		D lower cost	**core idea: increase product consumption**	E service quality		E	
			F supply flexibility	G product credibility	H competitors product strategies			
	F			G			H	

Fishbone Diagram

Also Called: Cause–and–Effect Diagram, Ishikawa Diagram

Variations: cause enumeration diagram, process fishbone, time–delay fishbone, CEDAC (cause–and–effect diagram with the addition of cards), desired–result fishbone, reverse fishbone diagram

The fishbone diagram identifies many possible causes for an effect or problem. It can be used to structure a brainstorming session. It immediately sorts ideas into useful categories.

When to Use a Fishbone Diagram

- When identifying possible causes for a problem.
- Especially when a team's thinking tends to fall into ruts.

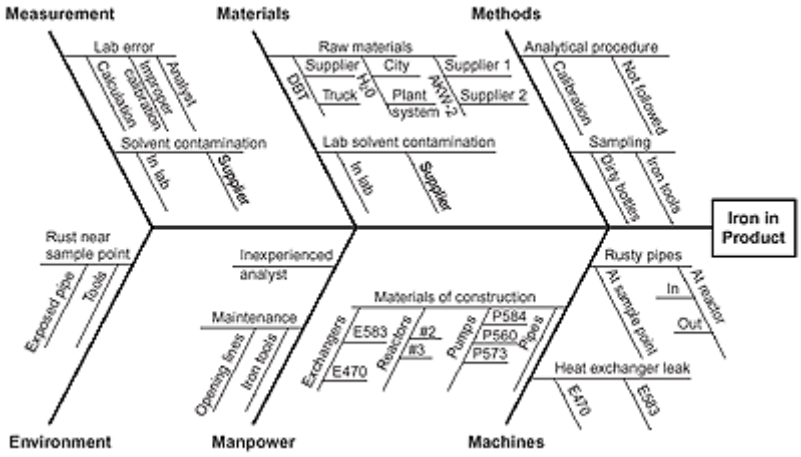
Fishbone Diagram Procedure

Materials needed: flipchart or whiteboard, marking pens.

1. Agree on a problem statement (effect). Write it at the center right of the flipchart or whiteboard. Draw a box around it and draw a horizontal arrow running to it.
2. Brainstorm the major categories of causes of the problem. If this is difficult use generic headings:
    - Methods
    - Machines (equipment)
    - People (manpower)
    - Materials
    - Measurement
    - Environment
3. Write the categories of causes as branches from the main arrow.
4. Brainstorm all the possible causes of the problem. Ask: "Why does this happen?" As each idea is given, the facilitator writes it as a branch from the appropriate category. Causes can be written in several places if they relate to several categories.
5. Again ask "why does this happen?" about each cause. Write sub–causes branching off the causes. Continue to ask "Why?" and generate deeper levels of causes. Layers of branches indicate causal relationships.
6. When the group runs out of ideas, focus attention to places on the chart where ideas are few.

Fishbone Diagram Example

This fishbone diagram was drawn by a manufacturing team to try to understand the source of periodic iron contamination. The team used the six generic headings to prompt ideas. Layers of branches show thorough thinking about the causes of the problem.



Fishbone Diagram Example

For example, under the heading "Machines," the idea "materials of construction" shows four kinds of equipment and then several specific machine numbers.

Note that some ideas appear in two different places. "Calibration" shows up under "Methods" as a factor in the analytical procedure, and also under "Measurement" as a cause of lab error. "Iron tools" can be considered a "Methods" problem when taking samples or a "Manpower" problem with maintenance personnel.

SWOT Analysis

Discover New Opportunities, Manage and Eliminate Threats

Find out more about SWOT, with James Manktelow and Amy Carlson.

SWOT Analysis is a useful technique for understanding your Strengths and Weaknesses, and for identifying both the Opportunities open to you and the Threats you face.

Used in a business context, it helps you carve a sustainable niche in your market. Used in a personal context, it helps you develop your career in a way that takes best advantage of your talents, abilities and opportunities.

This article looks at how to use the tool in a business context. (Click here to learn how to do a Personal SWOT Analysis.

Business SWOT Analysis

What makes SWOT particularly powerful is that, with a little thought, it can help you uncover opportunities that you are well-placed to exploit. And by understanding the weaknesses of your business, you can manage and eliminate threats that would otherwise catch you unawares.

More than this, by looking at yourself and your competitors using the SWOT framework, you can start to craft a strategy that helps you distinguish yourself from your competitors, so that you can compete successfully in your market.

How to Use the Tool

Originated by Albert S Humphrey in the 1960s, the tool is as useful now as it was then. You can use it in two ways – as a simple icebreaker helping people get together to "kick off" strategy formulation, or in a more sophisticated way as a serious strategy tool.

Tip:

Strengths and weaknesses are often internal to your organization, while opportunities and threats generally relate to external factors. For this reason, SWOT is sometimes called Internal-External Analysis and the SWOT Matrix is sometimes called an IE Matrix.

To help you to carry out your analysis, download and print off our free worksheet, and write down answers to the following questions.

Strengths

- What advantages does your organization have?
- What do you do better than anyone else?
- What unique or lowest-cost resources can you draw upon that others can't?
- What do people in your market see as your strengths?
- What factors mean that you "get the sale"?
- What is your organization's Unique Selling Proposition (USP)?

Consider your strengths from both an internal perspective, and from the point of view of your customers and people in your market.

Also, if you're having any difficulty identifying strengths, try writing down a list of your organization's characteristics. Some of these will hopefully be strengths!

When looking at your strengths, think about them in relation to your competitors. For example, if all of your competitors provide high quality products, then a high quality production process is not a strength in your organization's market, it's a necessity.

Weaknesses

- What could you improve?
- What should you avoid?
- What are people in your market likely to see as weaknesses?
- What factors lose you sales?

Again, consider this from an internal and external basis: Do other people seem to perceive weaknesses that you don't see? Are your competitors doing any better than you?

It's best to be realistic now, and face any unpleasant truths as soon as possible.

Opportunities

- What good opportunities can you spot?
- What interesting trends are you aware of?

Useful opportunities can come from such things as:

- Changes in technology and markets on both a broad and narrow scale.
- Changes in government policy related to your field.
- Changes in social patterns, population profiles, lifestyle changes, and so on.
- Local events.

Tip:

A useful approach when looking at opportunities is to look at your strengths and ask yourself whether these open up any opportunities. Alternatively, look at your weaknesses and ask yourself whether you could open up opportunities by eliminating them.

Threats

- What obstacles do you face?
- What are your competitors doing?
- Are quality standards or specifications for your job, products or services changing?
- Is changing technology threatening your position?
- Do you have bad debt or cash-flow problems?
- Could any of your weaknesses seriously threaten your business?

Tip:

When looking at opportunities and threats, PEST Analysis can help to ensure that you don't overlook external factors, such as new government regulations, or technological changes in your industry.

Further SWOT Tips

If you're using SWOT as a serious tool (rather than as a casual "warm up" for strategy formulation), make sure you're rigorous in the way you apply it:

- Only accept precise, verifiable statements ("Cost advantage of $10/ton in sourcing raw material x", rather than "Good value for money").
- Ruthlessly prune long lists of factors, and prioritize them, so that you spend your time thinking about the most significant factors.
- Make sure that options generated are carried through to later stages in the strategy formation process.

- Apply it at the right level – for example, you might need to apply the tool at a product or product-line level, rather than at the much vaguer whole company level.
- Use it in conjunction with other strategy tools (for example, USP Analysis and Core Competence Analysis) so that you get a comprehensive picture of the situation you're dealing with.

Note:

You could also consider using the TOWS Matrix. This is quite similar to SWOT in that it also focuses on the same four elements of Strengths, Weaknesses, Opportunities and Threats. But TOWS can be a helpful alternative because it emphasizes the external environment, while SWOT focuses on the internal environment.

Example

A start-up small consultancy business might draw up the following SWOT Analysis:

Strengths

- We are able to respond very quickly as we have no red tape, and no need for higher management approval.
- We are able to give really good customer care, as the current small amount of work means we have plenty of time to devote to customers.
- Our lead consultant has strong reputation in the market.
- We can change direction quickly if we find that our marketing is not working.
- We have low overheads, so we can offer good value to customers.

Weaknesses

- Our company has little market presence or reputation.
- We have a small staff, with a shallow skills base in many areas.
- We are vulnerable to vital staff being sick, and leaving.
- Our cash flow will be unreliable in the early stages.

Opportunities

- Our business sector is expanding, with many future opportunities for success.
- Local government wants to encourage local businesses.
- Our competitors may be slow to adopt new technologies.

Threats

- Developments in technology may change this market beyond our ability to adapt.
- A small change in the focus of a large competitor might wipe out any market position we achieve.

As a result of their analysis, the consultancy may decide to specialize in rapid response, good value services to local businesses and local government.

Marketing would be in selected local publications to get the greatest possible market presence for a set advertising budget, and the consultancy should keep up-to-date with changes in technology where possible.

Key Points

SWOT Analysis is a simple but useful framework for analyzing your organization's strengths and weaknesses, and the opportunities and threats that you face. It helps you focus on your strengths, minimize threats, and take the greatest possible advantage of opportunities available to you.

It can be used to "kick off" strategy formulation, or in a more sophisticated way as a serious strategy tool. You can also use it to get an understanding of your competitors, which can give you the insights you need to craft a coherent and successful competitive position.

When carrying out your analysis, be realistic and rigorous. Apply it at the right level, and supplement it with other option-generation tools where appropriate.