



# INNOVATION TRIGGERS AND SOURCES

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During my lectures and courses on TRIZ and Innovation, I am often asked, "What are main triggers which push people to innovate?". Thus I have tried to categorize main categories of such triggers for technical innovations:

- **Accidents** - Many new inventions were created on the basis of unexpected discoveries, made both in science and technology. For instance, x-rays, penicillin, microwave oven, vulcanized rubber, even potato chips resulted from accidents.
- **Analogy** - Many inventions resulted from observing nature and copying its principles. Leonardo da Vinci drew his flying machines and ships by copying nature. Composite materials, building structures emerged from observing natural systems. George de Mestrel invented Velcro fastener by studying why seeds of burdock kept sticking to his clothes and his dog's fur. Today such disciplines as biomimicry and biomimetics study principles of nature and copy them for technology use. Analogy is also often used by inventors to copy and transfer principles from one technical area to another one.
- **Problems caused by negative and harmful effects** - probably, the broadest trigger of innovations. We do not want anything to fail or behave incorrectly so we improve things. We do not want car accidents so we improve cars, roads, even traffic rules. Very often we can only achieve a necessary improvement through innovation. Chassis of heavy planes would not be possible without carbon-reinforced materials; refrigeration of food prevents it from degradation. Think about ultrasonic distance sensors for car parking, non-breaking glass, traffic jams detecting and predicting systems, and so forth.
- **Performance barriers** - they are created by the limits of principles of existing products and technologies. To break these limits, we need to invent a new product or a technology based on a new principle. A horse cannot run faster than 70 km/h, but a car can. The car can't run faster than 300 km/h, but a plane can. A wooden pointer cannot be longer than 1 meter (it can, but it will be useless), but a laser pen can project light much further. Computer memory in microchips has much higher capacity than memory based on vacuum tubes.
- **Evolving customer demands** – progress of technology and social life requires continuous growth of technical parameters, higher quality, more safety, new features. Market demands more computer memory capacity, more compact photo and video cameras, safer cars, faster internet speeds, larger TV screens, more features in a mobile phone, and so forth. Often such growth is only possible via innovations.
- **Hidden customer demands** - there are plenty of them! Someone can be the first to recognize that a demand exist and respond by creating new products and technologies. Often new demands emerge as a result of demographic, cultural, social changes or introduction of new products to the market which create new needs. One of the common innovation practices today is to observe customers behaviour and identify functions which can be delivered by new or improved products.

- **Eliminating needs** – often, new technologies emerge or existing ones are adopted to make our life easier and eliminate the needs to do some job or deliver some function. For instance, shopping on the Internet saves us a lot of time and eliminates the needs to go out. Using a satellite navigation system in a car eliminates the need to continuously look at the map.
- **Technology Diversification** occurs when a known technology or a product (or its principle) is used in a new context, or a new market. For instance, when the first laser was invented it was thought to be used in spectroscopy only. Today lasers are used in a very broad range of applications. A computer has existed for a long time as a computational device only, today it is a primary tool of communication, gaming device, music recording, and so forth. An ink-jet printer today is used not only to print on paper, but also print electronic components by using special solutions instead of ink.
- **Trends of Technology Evolution** - many seemingly different technologies and products evolve in similar ways. For instance, one of such patterns is evolution of the degree of dynamics by segmenting an existing system or a product to several connected parts. Such pattern applies to situations when we have our product to be small and big at different times. For instance, a mobile phone: we want a large screen, convenient large buttons and at the same time the phone should be small to provide portability. A solution is a sliding phone, or a flip-flop phone. Now think about travel bag which we can make bigger by unzipping its part, telescopic rod for an umbrella, foldable bicycle, foldable tourist tent, foldable camping table, etc.
- **Scientific research**, especially material research - today a major source of hi-tech innovations. Without it microelectronics would have not existed, and neither advanced materials like polymers, fine chemicals, new construction materials, new and more effective medicines, etc.
- **Cost-effectiveness** - we always want more value for lower costs, and costs depend not only on production scale or using cheaper solutions which decrease quality. Innovations help to cut costs while preserving quality and performance or even increasing them. Many ICT innovations emerge from this source. Online meeting systems cut costs for travel. Other examples are voice communication via the Internet, plastics which are stronger but cheaper than steel, disposable mobile phones, reusable plastic bottles, and so forth.
- **Market competition** – we should not forget this important trigger. Often there are no clearly visible problems or performance barriers related to our product or a system, but we know we must innovate to stay competitive. Probably, competition is a kind of meta-trigger which leads to the use of all above-mentioned triggers.