<u>Five Whys Analysis</u>

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In solving an inventive problem, it is very important to understand the casual relation of phenomena taking place in a system. Constructing such chains is a very interesting process which sometimes yields completely unexpected results.

The following story is popular in the engineering environment.

Auxiliary engines of one of the first American spaceships had 5 ft in diameter although, according to the designers' calculations, their optimal diameter should have been a little larger.

1. Why were the engines made with 5 ft diameter ?

The limitation was caused by that the engines were delivered to the assembly site by railway which went through several tunnels. The distance between the rails was standard – 4 ft and 8.5 and the tunnel diameter was not much larger.

#2. Why the standard distance between rails was 4 ft and 8.5? How did that figure arise?

The American railway was designed after the English pattern. In England, in turn, the distance between rails was selected by analogy with the tram track which was just 4 ft and 8.5.

But why?

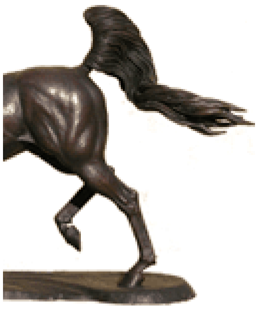
The thing is that first trams in England were produced at the same factory as horse-drawn vehicles. The distance between the wheels of such a vehicle was 4 ft and 8.5.

3. Why ?

Horse-drawn vehicles were made so that their wheels matched old ruts on roads and the distance between the ruts was 4 ft and 8.5 all over England.

4. Why exactly that distance?

First roads in Great Britain were broken by Romans, to be more exact, by their chariots. The length of a standard Roman chariot axle was – yes, you are quite right – 4 ft and 8.5. One thing is unclear. That length (4 ft and 8.5) is not an integer in any of the known systems of measures. Why did it occur to Romans to choose that length for chariot axles?



5. Why ?

The answer is simple. Two horses were usually harnessed to such a chariot. Four ft and 8.5 was just the average size of two horse croups. There goes the answer to the first question.

Even now, when the man goes to outer space, his advanced technical achievements often directly depend on the size of a horse which lived two thousand years ago.

Five Whys

Example

The following example demonstrates the basic process:

- My car will not start. (the problem)

1. *Why?* - The battery is dead. (first why)
2. *Why?* - The alternator is not functioning. (second why)
3. *Why?* - The alternator belt has broken. (third why)
4. *Why?* - The alternator belt was well beyond its useful service life and has never been replaced. (fourth why)
5. *Why?* - I have not been maintaining my car according to the recommended service schedule. (fifth why, root cause)

The questioning for this example could be taken further to a sixth, seventh, or even greater level. This would be legitimate, as the "five" in 5 Whys is not gospel; rather, it is postulated that five iterations of asking why is generally sufficient to get to a root cause. The real key is to encourage the troubleshooter to avoid assumptions and logic traps and instead to trace the chain of causality in direct increments from the effect through any layers of abstraction to a root cause that still has some connection to the original problem.

History

The technique was originally developed by Sakichi Toyoda and was later used within Toyota Motor Corporation during the evolution of their manufacturing methodologies. It is a critical component of problem solving training delivered as part of the induction into the Toyota Production System. The architect of the Toyota Production System, Taiichi Ohno, described the 5 whys method as "... the basis of Toyota's scientific approach ... by repeating why five times, the nature of the problem as well as its solution becomes clear."[1] The tool has seen widespread use beyond Toyota, and is now used within Kaizen, lean manufacturing, and Six Sigma.