Gartner’s Hype Cycle: A Simple Explanation

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1. Gartner’s Hype Cycle

- In the ideal world, any good innovation should be gradually accepted.
- It is natural that initially some people are reluctant to adopt a new largely un-tested idea.
- However:
  - as more and more evidence appears that this new idea works,
  - we should see a gradual increase in number of adoptees –
  - until the idea becomes universally accepted.
- In real life, the adoption process is not that smooth.
2. Gartner’s Hype Cycle (cont-d)

• Usually, after the few first successes:
  – the idea is over-hyped,
  – it is adopted in situations way beyond the inventors’ intent.

• In these remote areas, the new idea does not work well.

• So, we have a natural push-back, when:
  – the idea is adopted to a much less extent
  – than it is reasonable.

• Only after these wild oscillations, the idea is finally universally adopted.

• These oscillations are known as *Gartner’s hype cycle*. 


3. Gartner’s Hype Cycle (cont-d)

- A similar phenomenon is known in economics:
  - when a new positive information about a stock appears,
  - the stock price does not rise gradually.
- At first, it is somewhat over-hyped and over-priced.
- And only then, it moves back to a reasonable value.
4. Our Explanation

- Any system is described by some parameters

\[ x_1, \ldots, x_n. \]

- The rate of change \( \dot{x}_i \) of each of these parameters is determined by the system’s state, i.e.:

\[ \dot{x}_i = f_i(x_1, \ldots, x_n). \]

- In the first approximation, we can replace each expression by the first few terms in its Taylor expansion.

- For example, we can approximate it by a linear expression:

\[ \dot{x}_i = \sum_j a_{ij} \cdot x_j. \]

- A general solution of such systems of linear differential equations is known.
5. Our Explanation (cont-d)

- In the generic case, it is:
  - a linear combination of terms $\exp(\lambda_k \cdot t)$,
  - where $\lambda_k$ are (possible complex) eigenvalues of the matrix $a_{ij}$,
  - i.e., roots of the corresponding characteristic equation
    \[ P(\lambda) = 0. \]
- When the imaginary part $b_k$ of $\lambda_k = a_k + i \cdot b_k$ is non-zero:
  - we get:
    \[ \exp(\lambda_k \cdot t) = \exp(a_k \cdot t) \cdot \left( \cos(b_k \cdot t) + i \cdot \sin(b_k \cdot t) \right), \]
  - i.e., we get oscillations.
6. Our Explanation (cont-d)

• Why do we see oscillations practically always?

• The more parameters we take into account, the more accurate our description; thus:
  – to get a good accuracy,
  – we need to use large $n$.

• Any polynomial can be represented as a product of real-valued quadratic terms.

• Some of these quadratic terms have real roots.

• If $p_0$ is the probability that both roots are real, then:
  – for a polynomial of order $n$,
  – the probability $p$ that all its terms have real roots is:
    $$p \approx p_0^{n/2}.$$ 

• For large $n$, this is practically 0.
7. Our Explanation (cont-d)

- Thus, practically all polynomials have at least one non-real root.
- So, almost all systems show oscillations.
- This explain why Gartner’s hype cycle is ubiquitous.