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Continuous Improvement Associates

The Product Life Cycle

Every organization is concerned about product or service growth & decline

Here's how to understand what's happening



Why is the product life cycle important?

When we understand it, we can think more productively about the factors that influence gaining and losing customers. Explicitly examining these factors can help us increase our ability to serve the market and improve profitability.

A simple example

To understand the basics and how they can be extended, we can examine the structure that explains the standard product life cycle (Figure 1). The **gaining customers** curve shows that **customers** adopt the product slowly at first, then it peaks and declines. The growth of the number of **Customers** follows what is known as the "S-curve."

Why use systems thinking?

Systems thinking helps us understand system structure. And system structure is responsible for system behavior.

System dynamics

The language of system dynamics is helpful in explaining structure. This is the language of *stocks and flows*. *Stocks* are accumulations of things. *Flows* are the inflows and outflows that fill and drain the stocks. For example, a lake is the accumulation of the rivers that flow in and out. Accountants recognize the difference between a balance sheet (a stock) and a profit & loss statement (flows).

Valves control flows. By observing the values of stocks,

What is systems thinking?
Seeking to understand system behavior by examining "the whole" ... instead of by analyzing the parts.

we can know how to adjust flows. For example, when we fill a bathtub, we observe the level and turn off the tap when the water reaches the desired level.

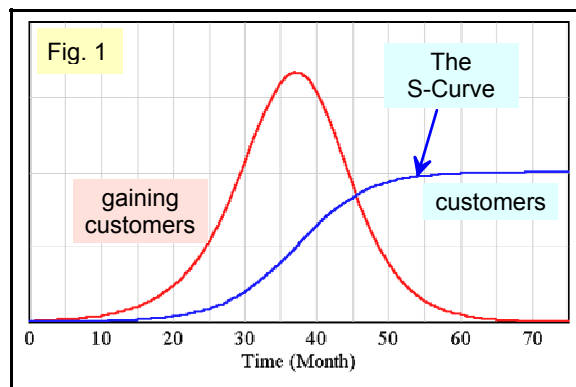
Converting potential customers

Figure 2 shows that **Potential Customers** are converted into **Customers** as they flow through the valve, **gaining customers**. Of course, customers can also be lost (omitted here for simplicity).

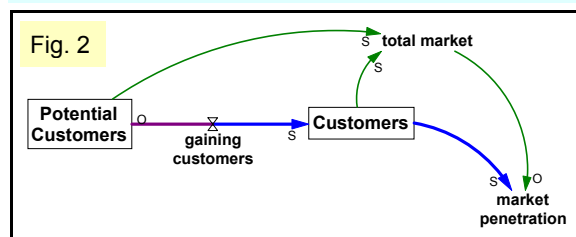
The **total market** is the sum of **Potential Customers** and **Customers**. And **market penetration** is our fraction of the market: $\text{Customers} / \text{total market}$.

Market growth

One way markets grow is by word of mouth. **Customers** talk to **Potential Customers**; soon everybody's got to have a pet rock and **Potential Customers** are converted.



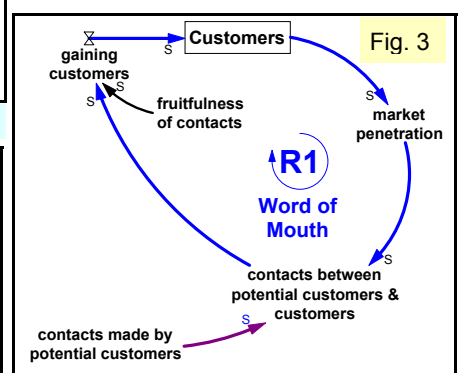
These are the typical profiles of the product life cycle.



This "stock & flow" structure shows Customers flowing from the "bucket" of Potential Customers into Customers.

So the value of **gaining customers** is the **fruitfulness of contacts** multiplied by the number of **contacts between potential customers & customers**.

The second of these two variables is the fraction of the **contacts made by potential customers with Customers** ... the **market penetration** determines this fraction. This reinforcing loop, **R1: Word of Mouth**,



Positive "Word of Mouth" is a powerful feedback for gaining customers.

Keep it simple?
Everything should be made as simple as possible, ... but not simpler.
Albert Einstein, 1879 - 1955

drives product acceptance.

Nothing grows forever

Distressing, but true. Every reinforcing process eventually encounters some limit to growth (Figure 4). For example, in product markets we eventually run out of **Potential Customers**.

The **contacts made by potential customers** is the product of their sociability and the number of **Potential Customers**. This forms loop, **B2: Market Saturation**.

Getting started

The problem with the structure described so far is that, with no customers to start with, **market penetration** is zero. The **Word of Mouth** loop can't get going.

Sometimes companies give away product to gain initial customers. Or they can get customers by advertising (Figure 5). How many are gained is a result of **advertising effectiveness**, which converts some **Potential Customers** into **Customers**. This drains **Potential Customers** and creates another balancing loop that we can call **B3: Advertising Market Saturation**.

Altogether now

Figure 6 contains the entire structure. A computer simulation of this structure created the graph in Figure 1. The simulation set **advertising effectiveness** to zero and initialized **Customers** at 0.1% of **Potential Customers** to overcome the startup problem.

Without loop B3, the form of the model is the same as for the transmission of infectious disease from a susceptible population to an infectious population.

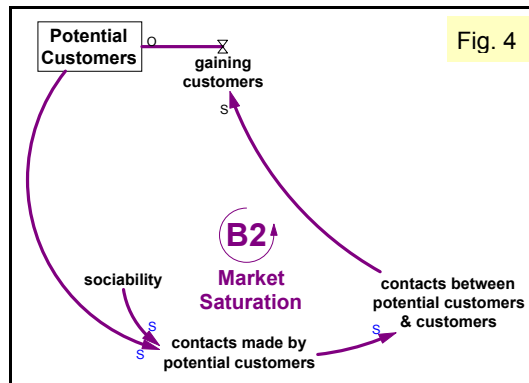


Fig. 4

... but as we gain Customers, the flow slows because we drain the "bucket" of Potential Customers.

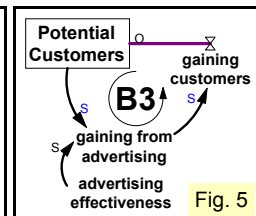


Fig. 5

Advertising gains decline after an initial boost.

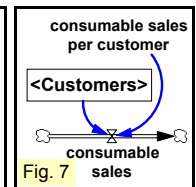


Fig. 7

Expanding the model for consumable sales.

The equations represented by this model are the same as the Bass diffusion model of innovation (1969), though Bass did not explicitly discuss the feedback structure that creates the operational processes responsible for the behavior.

New products & consumables

If products have a long life, there is a problem when all **Potential Customers** are converted to **Customers**. Planned obsolescence is an option, but that makes the company vulnerable to competition. Other options are to develop new products and/or sell consumables.

New products, or new product families, create a series of overlapping curves that lead to continuing sales (e.g., HP printers). A danger is that a

company can cannibalize its own product line. The consumables option (Figure 7) is attractive because those sales continue when the market is saturated (e.g., HP ink cartridges). Sometimes companies even give the product away to boost sales of consumables (e.g., cell phones).

Conclusion

A product life model can be enhanced to include losing customers, market size changes, pricing effects, attractiveness relative to competitor products, ... among others, to improve planning and learning.

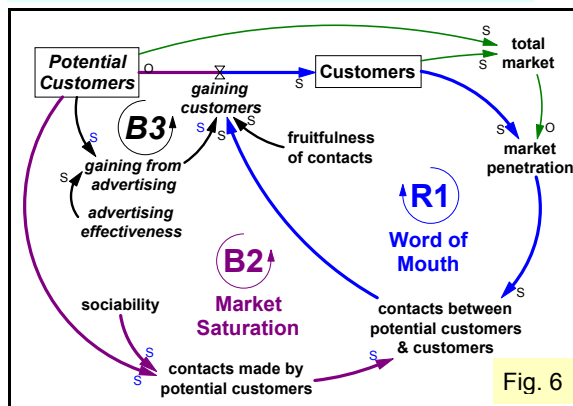


Fig. 6

Putting all the pieces together, we have a basic "stock & flow" model ... a theory ... of product market growth and decline.

"Success and failure arise primarily as a result of the internal system structure and policies, even where it's clear there was an external cause."

Jay Forrester, founder of system dynamics

Feedback is Power - Tap It

"To create realistic and useful models of product diffusion and innovation adoption, you must explicitly portray the feedback structure of adoption and growth, including the sources of attractiveness for the new idea or product, the competition, technical innovation, changing criteria of use and other factors that influence adoption and growth. Only models that capture the causal structure of the system will respond accurately as conditions change and policies are implemented."

John Sterman in *Business Dynamics*

Workshop Benefits

Thinking about an organization's products and services in the context of systems diagrams is an opportunity for group learning. It's a vital element for improving organizational performance, because it explicitly builds shared understanding and alignment.

How do we change thinking & behavior?

"If you want to change people ... forget it. Give them a tool, the use of which over time will change them."

Peter Senge on comments by Buckminster Fuller

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