



Managing Dynamic Complexity & TPS

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*making a difference through
professional growth*

The March of Toyota

1957 – Began operations in the U.S.

1975 – Became #1 import in U.S. market

2003 – Became the 2nd largest auto maker in the world behind GM.

2006 – Became the number 2 selling automotive company in U.S. Market.

2007 – 1st quarter world wide sales #s surpass GM for the first time.



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Industry Week

“While U.S. Manufacturers in many sectors have used practices from the Toyota Production System (TPS) to boost performance substantially since the Mid- 80s, they have used it improperly, experts say, instead of embracing TPS as an overarching philosophy, they have used it as a piecemeal toolbox. These companies’ leaders must revive their strategies to mimic Toyota’s in order to compete, which means reversing the popular notion that lean and other TPS-derived concepts are tools to be used selectively to achieve departmental milestones.”

February 2006, p.34

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Interpreting the Experts’ Advice

- Is it reasonable to assume that competitors can achieve Toyota’s success simply by mimicking them?
- Is mimicking the TPS (even in its entirety) the same as mimicking Toyota’s strategy?
- If ***mimicking*** the TPS is not what manager’s should do, what should they be doing instead?

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Without changing our patterns of thought, we will not be able to solve the problems that we created with our current patterns of thought.

- Albert Einstein



The Analytical Process

1. Take a complex phenomenon to be understood and break it down (physically or conceptually) into its logical parts.
2. Try to understand the behavior of the individual parts.
3. Based on the understanding of how the parts work in isolation, establish a theory of how the more complex object works.



The Inadequacy of Analysis When Working With Systems

- System behavior is not determined by how the parts act in isolation, but rather how they *interact*.
- Analysis helps us understand what the parts of a system are and how they work, but not *why* they work.
- To understand why a system works the way it does you have to do the opposite of traditional analysis. You have to look at the *big picture*.



The Need for Systems Thinking

Systems thinking approaches have evolved within a variety of fields to help people understand complex system behavior.



The Need for Systems Thinking

Characteristics of Complex System Behavior

- Cause & effect are often separated both in terms of time & space.
- Actions that improve a situation in the short-term often create bigger problems in the long-term and actions that make things worse in the short-term often have long-term positive impact.



The Need for Systems Thinking

Characteristics of Complex System Behavior

- The result - people often do not learn from their mistakes.
 - Separation of C&E often result in one person creating a cause and another experiencing its ultimate effect.
 - Due to the differences in short and long term effects, what a person learns from the short-term result of a decision is completely different from the true long-term outcome.



The Need for Systems Thinking

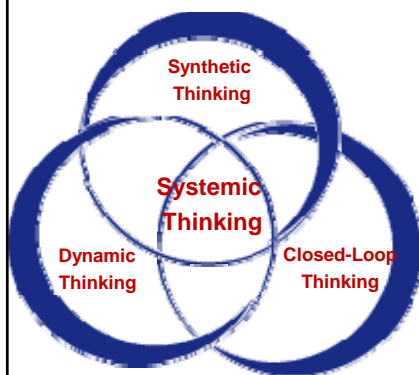
Characteristics of Complex System Behavior

- The subsystems and parts of a system interact using multiple, nonlinear feedback loops. This complex flow of interactions often creates other counterintuitive behavior.



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Elements of Systemic Thinking



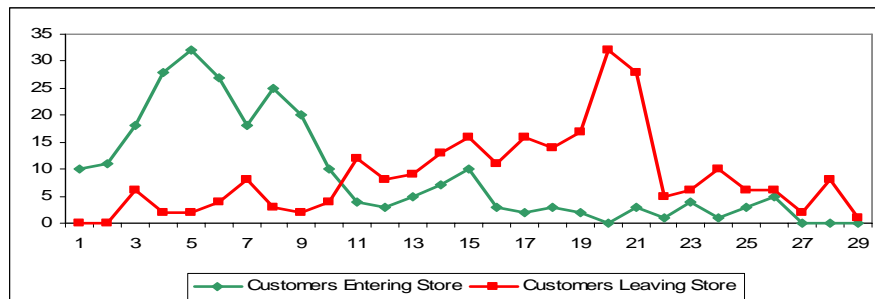
- **Synthetic Thinking** - studying the role and purpose of a system and its parts to understand why they behave as they do.
- **Dynamic Thinking** - examining how the system and its parts behave over time.
- **Closed-Loop Thinking** - investigating how the parts of a system react and interact to each other and external factors.



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A Simple Dynamic Complexity Quiz

The chart below shows the number of customers entering and leaving a store for the 1st 30 minutes after it opens.



1. Approximately when did the most customers enter the store? Can't be determined
2. At what point did the most customers leave the store? Can't be determined
3. At what point were the most people in the store? Can't be determined
4. At what point (after opening) were the fewest people in the store? Can't be determined

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Closed Loop Thinking vs Linear Thinking

The Case of Aggie Inc.

Aggie Inc. is a \$200 million division of a Fortune 500 company. It sells educational products to a wide range of customers. For more than a decade, Aggie performed well earning healthy profits. Then, for some reason sales slowed. Aggie's management reacted quickly by initiating an aggressive sales campaign. Sales rebounded briefly then started dropping again. Further analysis showed that customer complaints related to billing errors and delivery problems had risen sharply. Also, the time spent on new accounts had increased alarmingly and profits were dropping faster than sales.

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Typical Linear Approach

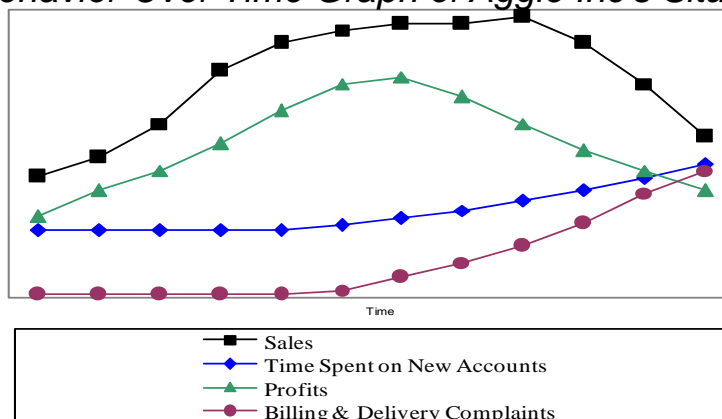
Form improvement teams to address each problem:

- Study Billing Process to identify methods to mistake proof commonly made errors.
- Study Delivery Process look for ways to streamline & simplify deliveries.
- Hire consulting experts in sales procedures to identify better sales processes. Provide training on new improved sales procedures.



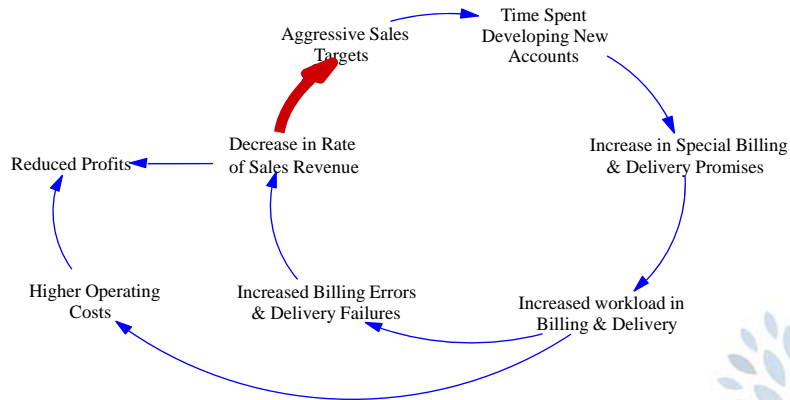
Taking A Systemic Approach

A Behavior Over Time Graph of Aggie Inc's Situation



Taking A Systemic Approach

Study the Behavior Over Time Graph and perform detailed investigation to determine how these events may be related. Use the information to build a Causal Loop Diagram.



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The Purpose of TPS: A New Perspective

“In terms of results, it (TPS) involves reducing work-in-process, raising productivity, and lowering costs. ***But the real aim is to bring out the capabilities of each individual. The ultimate aim is to draw out people’s motivation.***”

Michakazu Tanaka former Managing Director of Daihatsu Kogyo trained in TPS by Taiichi Ohno – Taken from “Inside the Mind of Toyota” p. 241

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TPS Related to Systems Thinking

Three aspects of the TPS that managers should imbed in their production system whether they choose to mimic it or not:

1. *Make the purpose of the system visible to all parties involved.*
2. *Ensure all feedback loops are visible and all sources are informed and involved.*
3. *Monitor behavior over time of key variables and minimize delays between changes and reactions.*

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Concluding Thoughts...

- Mimicking will not result in sustainable ongoing improvement.
- Develop a problem solving - oriented environment where employees think systemically.
- Understanding the system is NOT the same as systemic thinking.
- Systems thinking, TPS & Lean concepts apply to ALL environments.
- Systems thinking \Rightarrow Learning \Rightarrow Continuous improvement

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