



System Dynamics Insights

For

Balancing in a Corporate Storm

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Abstract :

The changing market conditions and competitive response affect the health of a corporation. The typical firm adjusts rapidly by adopting new technology and changing its culture to counter its external impacts. This causes stress in the infrastructure. A corporation can see how others rate its overall health by its stock performance. It is much more difficult for it to determine how well each of its constituent organizations are responding to those external influences and maintaining their balance in the corporate storm

In this paper, we look at an individual technology organization within Boeing that is striving for its ability to respond to such stress and further the corporate vision. It has set momentum hypotheses that focus on customer satisfaction as its key mission. Using system dynamics simulation, within a Balanced Scorecard framework, we were able to turn our insights into actions. We show how convergence of the new policies with the organization's original focus on resolving issues at root cause level the organization was able to effectively implement its policies for a longer-term affect.

Key words:

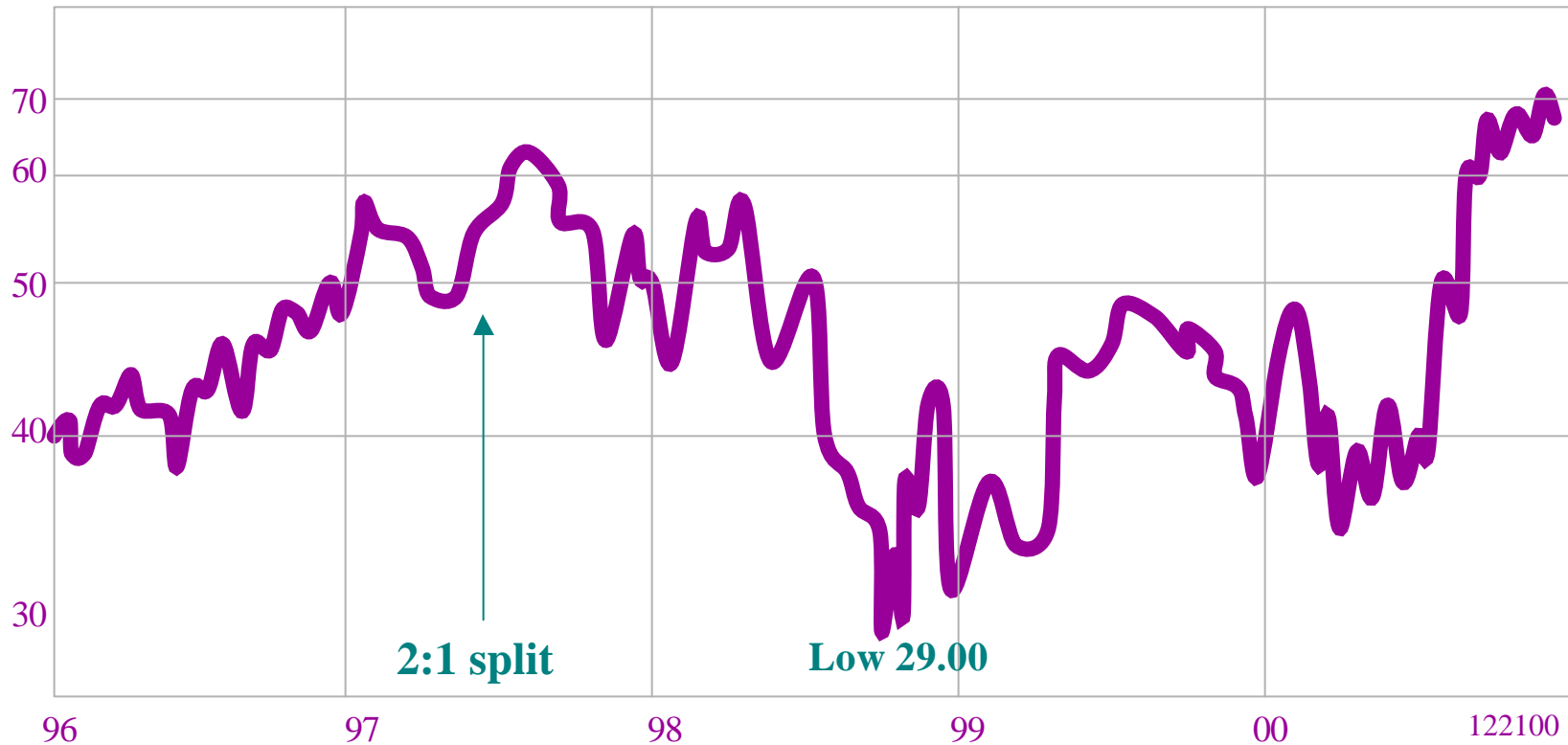
Corporate Leadership, Strategic, Change, Technology, Research, Balanced Scorecard

Presentation Overview

- A 5-year look at Corporation's Stock Performance
- Problem Statement and Reference Modes of one of its Technology Organization
- Mapping Momentum Hypotheses to a Balanced Score Card (BSC)
- The System Dynamics Model in a BSC Framework
- The Dynamics between the Four Components of BSC:
 - Customer Satisfaction
 - Budget
 - Internal Operations
 - Learning and Growth
- The External affects on Corporation's Performance
- System Dynamics Insights & Recommendations

The Boeing Company 5-year Stock Performance on 12/21/00

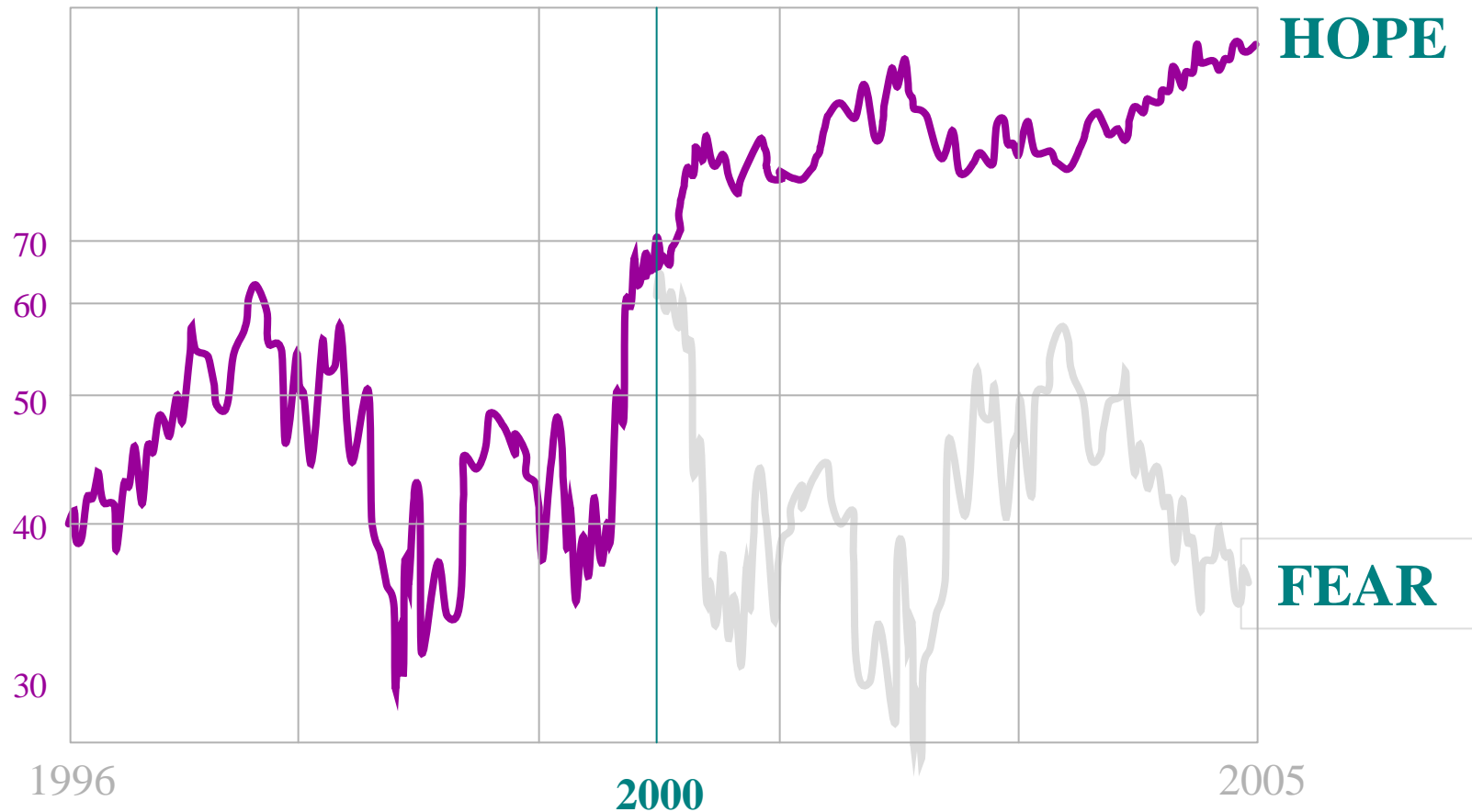
Split-adjusted cost basis per share on that date



**What can an individual organization do to affect
the future stock performance of Boeing?**

Our Challenges Today

How do we maintain balance in the complex World of Dynamics today and prepare for a even more complex World of tomorrow?



Stock Performance

Background and Study Objectives

- **Study Objective -- Use simulation modeling as a foundation to:**
 - Gain insights into future growth of products and services in a corporation
 - Understand dynamics and intra- and inter-relationships of a system and market demands
 - Focus on outcomes of policy making and implementations in individual organizations
- **A MIT Real-World System Dynamics Project**
 - A case study for a technology organization
 - Follow MIT's "Standard Method" to guide the study and build simulation models
 - Study timeline: 10/2/00 - 12/23/00

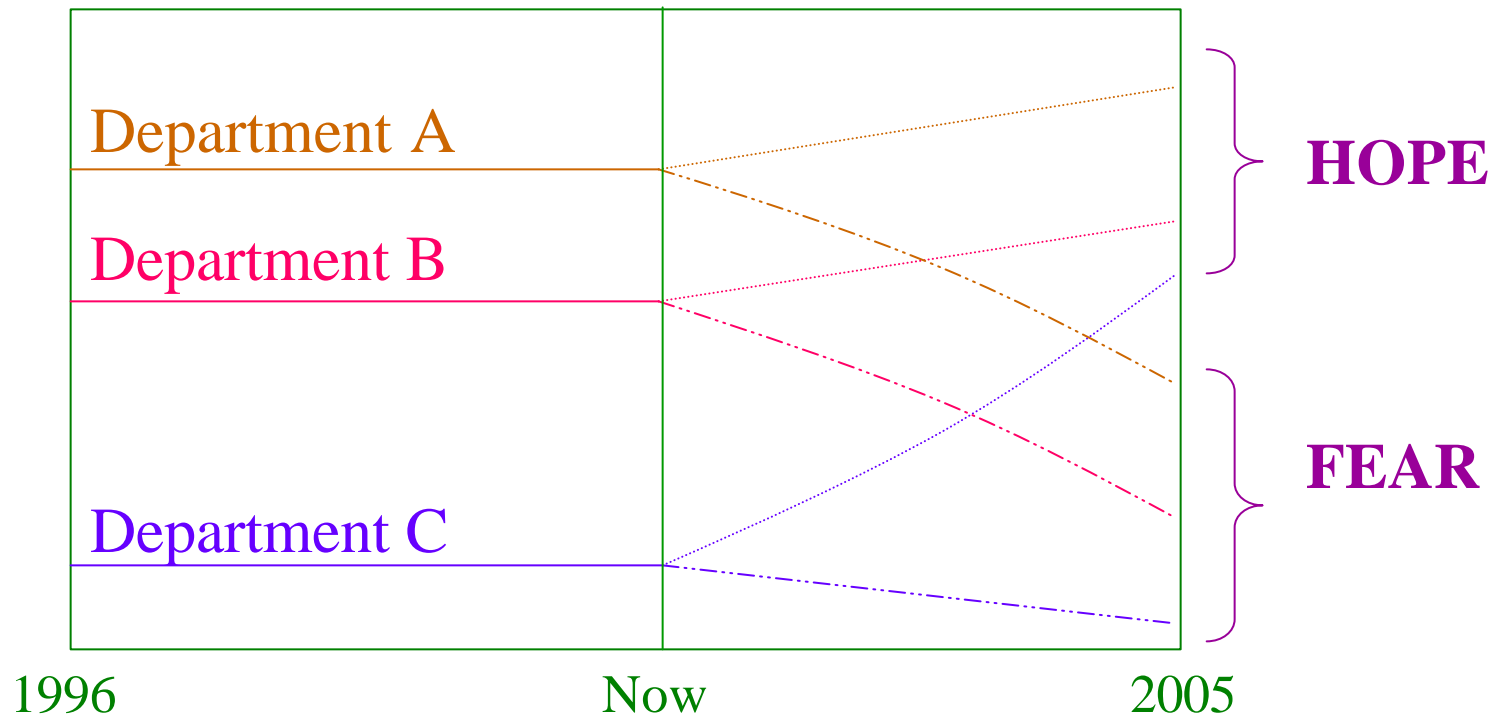
Problem Statement

(10/27/00)

Despite new initiatives and company emphasis on innovations, we're having difficulty in addressing divisional customer needs. We have more work than people and budget. We want to find policies to maintain the growth capability to keep up with our divisional customer demands.

Key Reference Mode

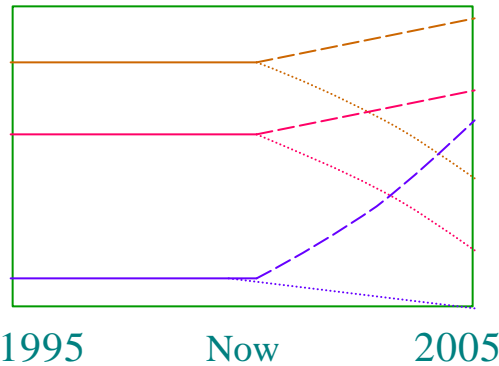
Customer Satisfaction



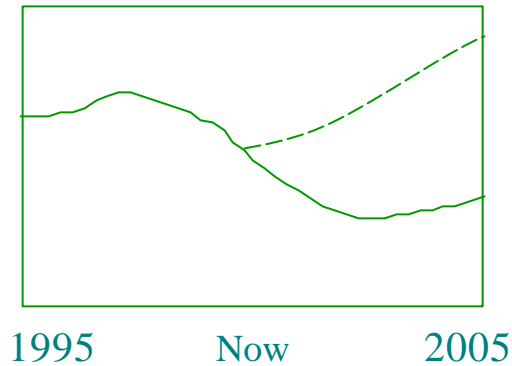
Reference Modes

Department A ———
Department B ———
Department C ———
All ———

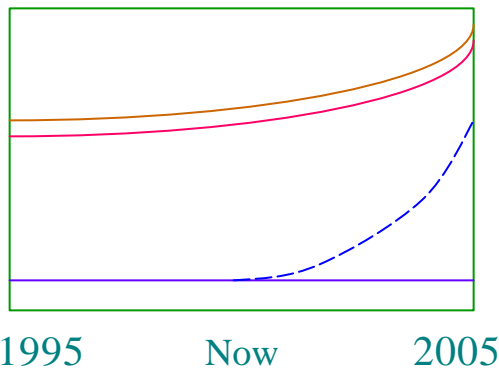
Customer Satisfaction



Skill Retention



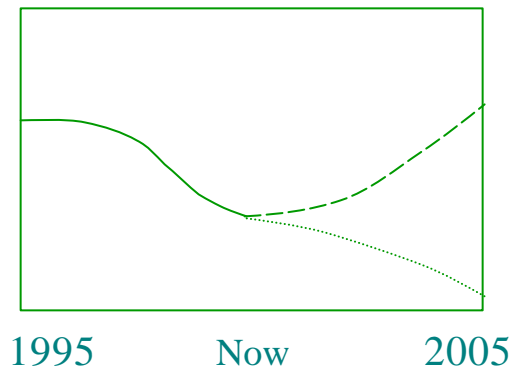
Customer Needs



Budget



Morale



As a technology Organization, satisfying internal customers' needs is a key to ensure company's future growth

Categorizing Momentum Hypotheses Using Balanced Scorecard

Customer Satisfaction

- Achieve high customer satisfaction
- Work with divisional VPs for their needs
- Build customer relationships for new initiatives
- Prioritize customer needs and direction

Internal Operations

- Understand employee dynamics

Finance Budget Allocation

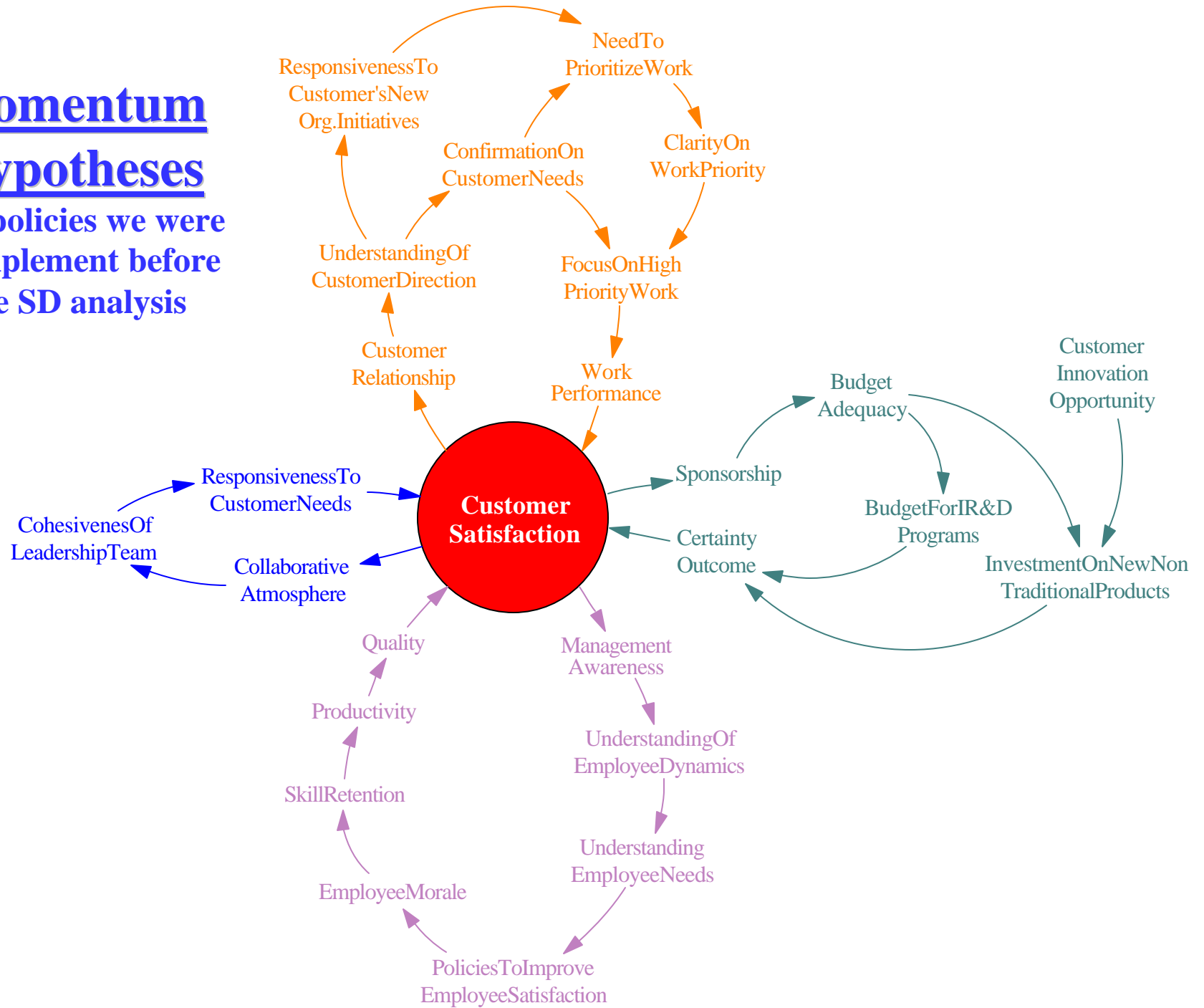
- Allocate budget against IR&D programs
- Budget for new non-traditional investments
- Budget for certainty outcome

Learning and Growth

- Build closer workforce relationship

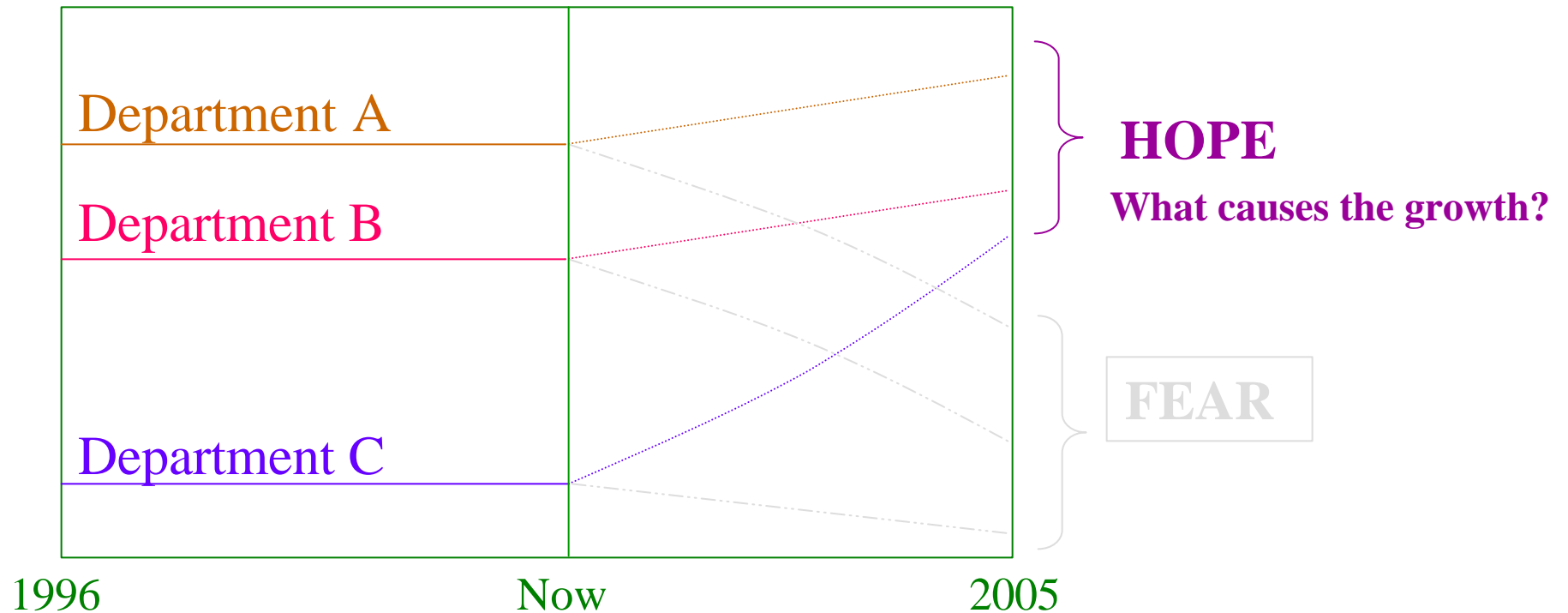
Momentum Hypotheses

The policies we were
to implement before
the SD analysis



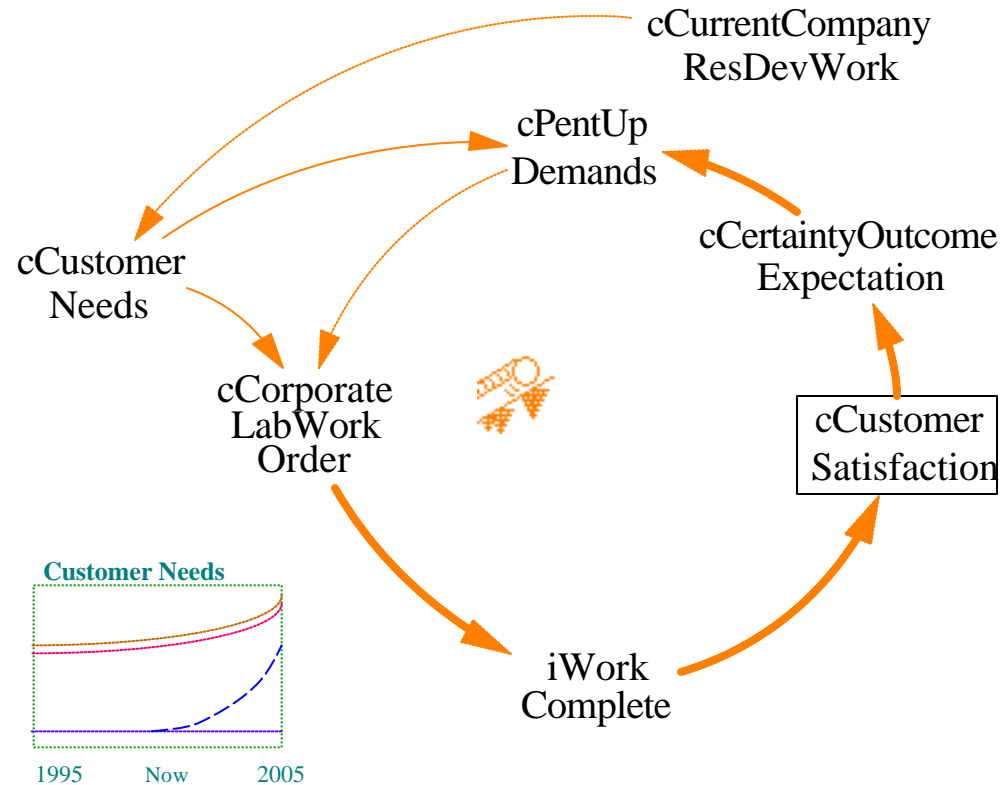
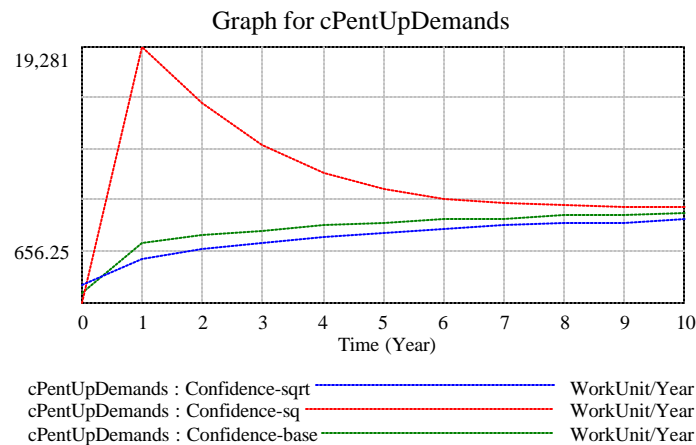
Hope -- Growth

Customer Satisfaction



Customer Satisfaction Leads to Pent-up Demands

A weak or implicit link between them and the official work order, leads to a weak positive loop

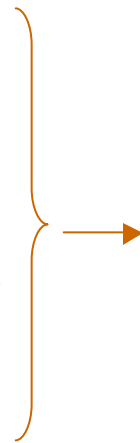


Strengthen the link by managing customer expectations, especially the “Pent-up Demand” creates mutual understanding and ultimately, leads to realistic customer satisfaction

Matching Momentum Hypothesis with Insights

Momentum Hypotheses - Customer Satisfaction

- Achieve high customer satisfaction
- Work with divisional VPs for their needs
- Build customer relationships for new initiatives
- Prioritize customer needs and direction



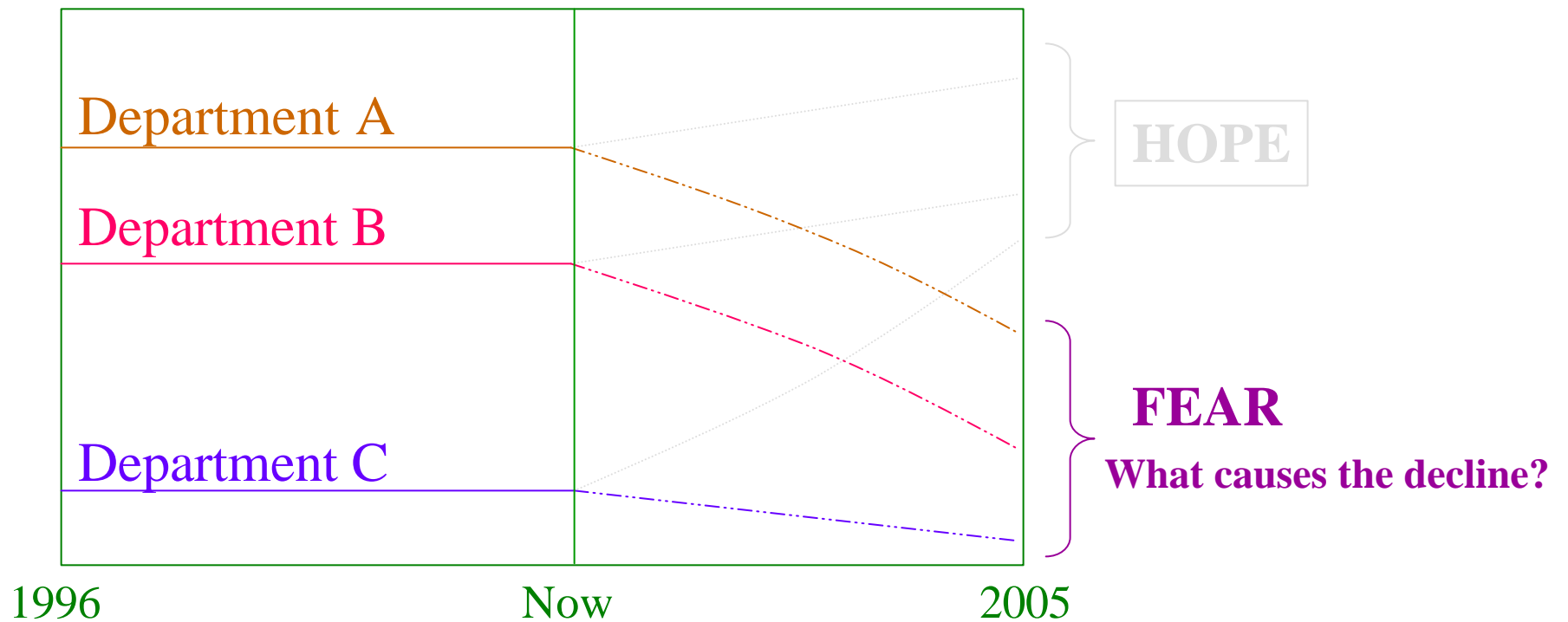
System Dynamics Insights

- Customer satisfaction leads to unplanned pent-up demands
- Understand the affect of pent-up demands on workload increase
- Manage customer expectations
- Mutually understand and agree on work statement outcome expectations

Customer Satisfaction is a key to success. However, we need to manage customer expectations so we can enable ourselves to maintain the high quality and performance.

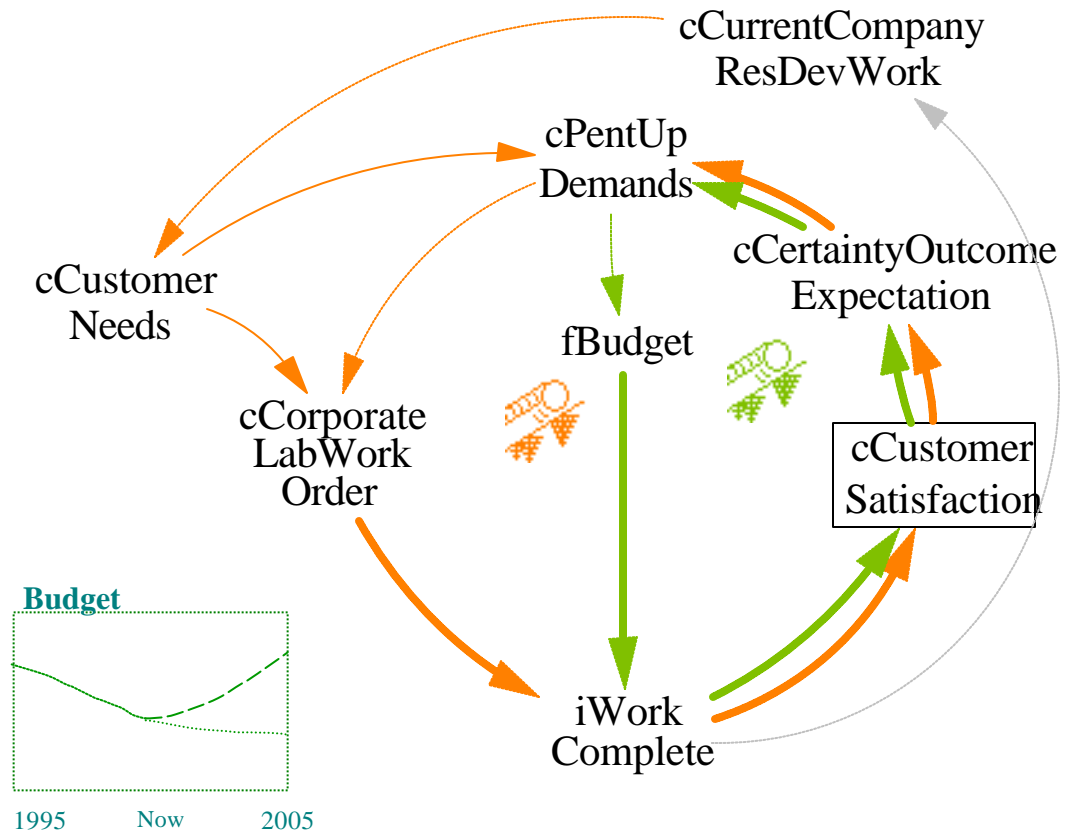
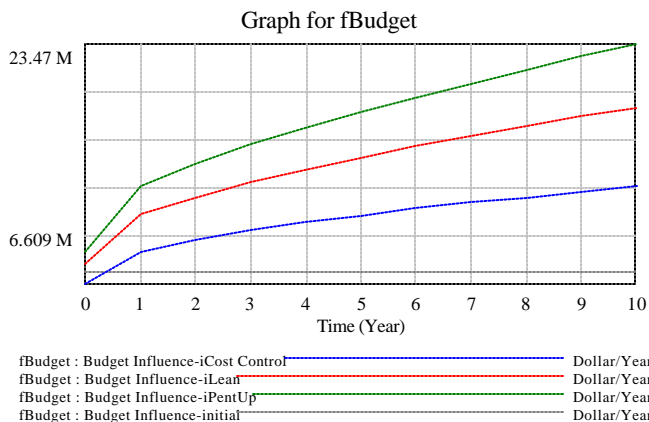
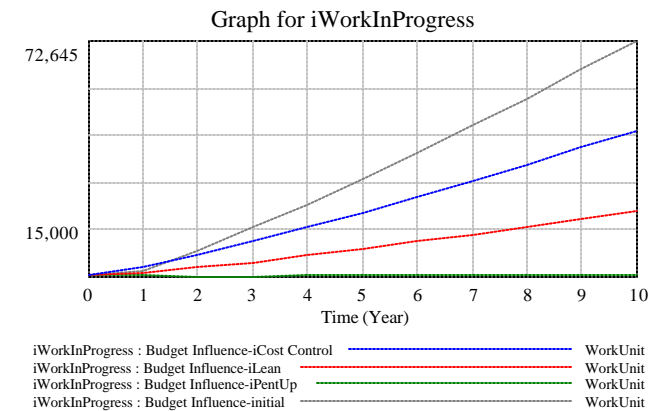
Fear -- Decline

Customer Satisfaction



Linking Budget to Work Order

There is no link or a very weak between Budget and Total Work Order, budget is established by fixed initial estimates and not with “Pent-up Demand” increase.



Two supposedly tightly connected + loops going against each other. Increase in workload causes delivery delay, and decrease in customer satisfaction which leads to decrease in budget. As a result, budget seems to be affected ONLY by negative customer satisfaction.

Matching Momentum Hypothesis with Insights

Momentum Hypotheses - Finance Budget Allocation

- Allocate budget against IR&D programs
- Budget for new non-traditional investment
- Budget for certainty outcome



System Dynamics Insights

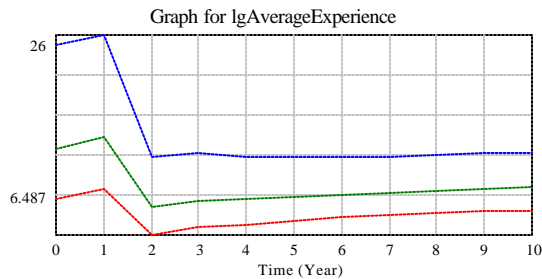
- Reconnect, strengthen and make visible the link between Budget and Work Order
- Establish a baseline for budget
- Match budget with pent-up demands

**Manage customer expectations to match budget
with pent-up demands.**

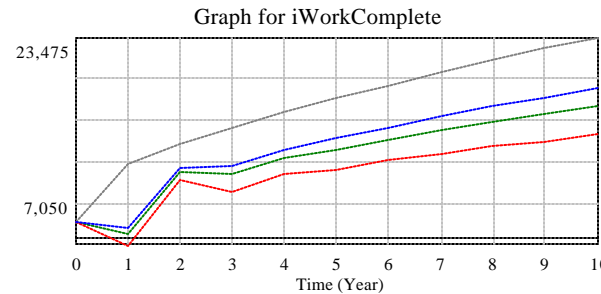
No more the “Good Guy” favors!

Budget discrepancy affects Workforce

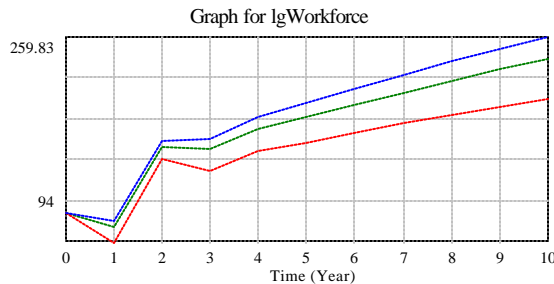
External market competition agitates cost control and going lean which lead to budget discrepancy.



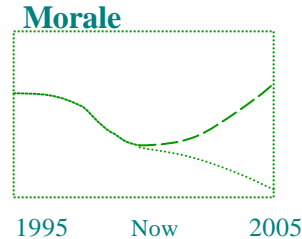
IgAverageExperience : Workforce Attrition-double — Years
 IgAverageExperience : Workforce Attrition-half — Years
 IgAverageExperience : Workforce Attrition-10yrs — Years



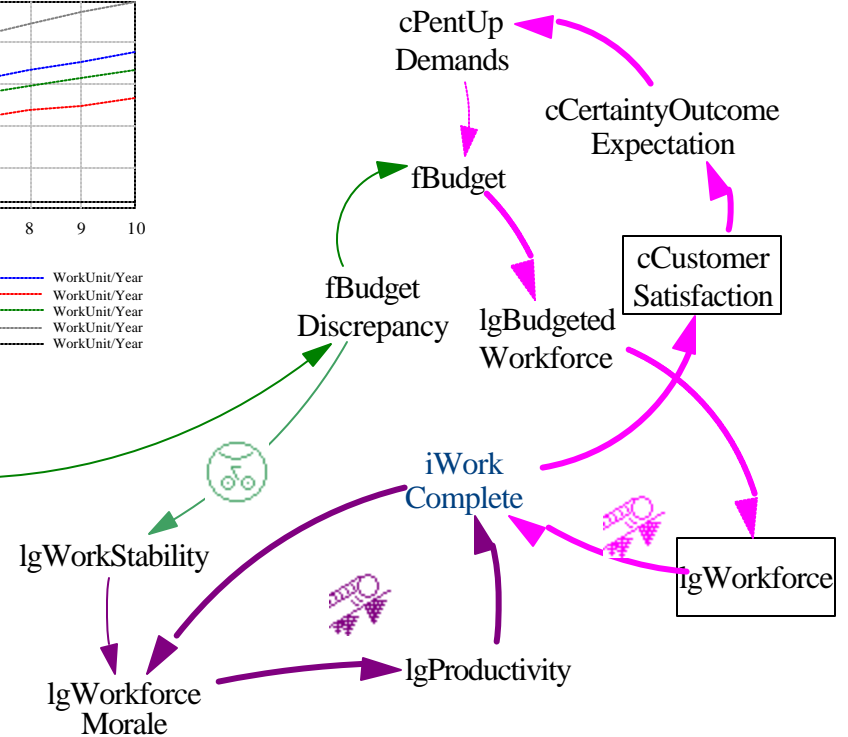
iWorkComplete : Workforce Attrition-double — WorkUnit/Year
 iWorkComplete : Workforce Attrition-half — WorkUnit/Year
 iWorkComplete : Workforce Attrition-10yrs — WorkUnit/Year
 iWorkComplete : Budget matches PentUp — WorkUnit/Year
 iWorkComplete : Budget stays constant — WorkUnit/Year



IgWorkforce : Workforce Attrition-double — People
 IgWorkforce : Workforce Attrition-half — People
 IgWorkforce : Workforce Attrition-10yrs — People



eMarket Competition



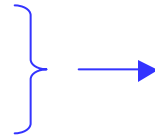
Budget affects workforce capacity, hence amount of work being done, which leads to customer satisfaction.

Budget discrepancy leads to workforce instability, affects morale and productivity.

Matching Momentum Hypothesis with Insights

Momentum Hypotheses - Internal Operations

- Understand employee dynamics



System Dynamics Insights

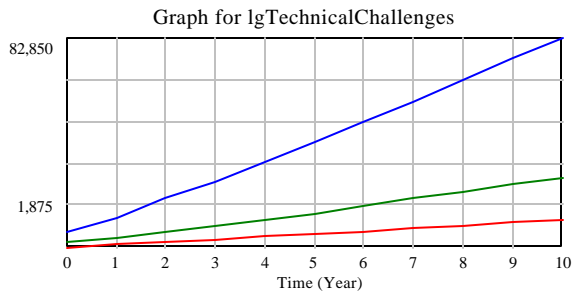
- Employee dynamics depends on workforce stability.
- Workforce morale has a very close link to workforce stability
- Productivity can be severely impacted by morale

Maintain a stable workforce environment.

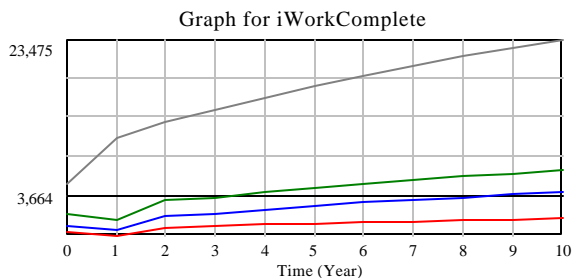
Minimize impacts of market competition on work force fluctuations

Employees Need Growth

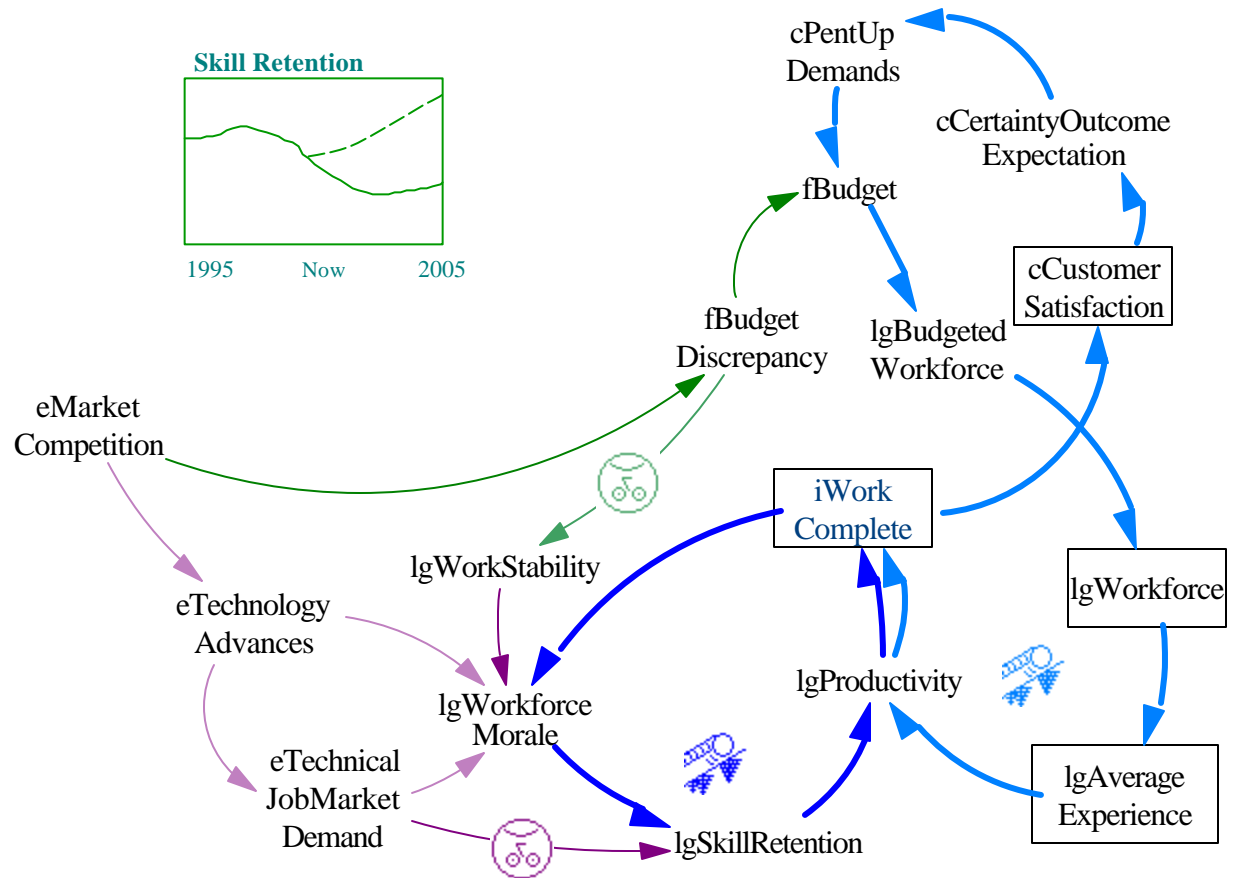
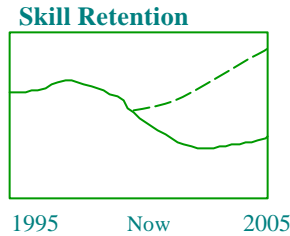
External market competition stimulates technology advances and technical job market demands.



IgTechnicalChallenges : Market Affect on Productivity-double WorkUnit
 IgTechnicalChallenges : Market Affect on Productivity-half WorkUnit
 IgTechnicalChallenges : Market Affect on Productivity WorkUnit



iWorkComplete : Market Affect on Productivity-double WorkUnit/Year
 iWorkComplete : Market Affect on Productivity-half WorkUnit/Year
 iWorkComplete : Market Affect on Productivity WorkUnit/Year
 iWorkComplete : Budget matches PentUp WorkUnit/Year
 iWorkComplete : Budget stays constant WorkUnit/Year

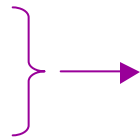


As a technology organization, technical challenges keep employees tick and affects morale and skill retention. However, technical job market demands also negative impact morale and skill retention

Matching Momentum Hypothesis with Insights

Momentum Hypotheses - Learning and Growth

- **Build closer workforce relationship**



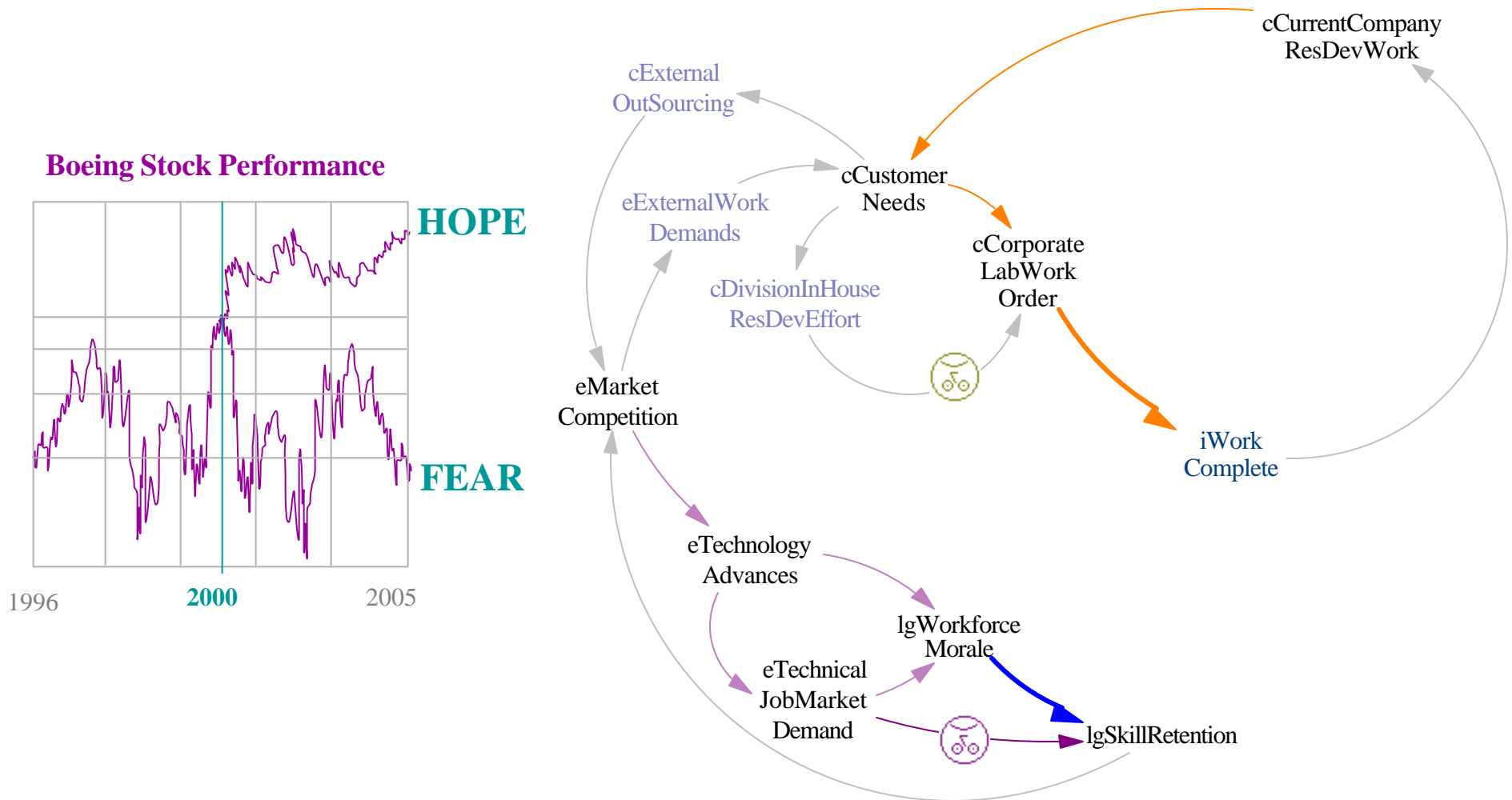
System Dynamics Insights

- **Focus on stimulating technical challenges and innovations**
- **Eliminate and unlearn rules and regulations that no longer serve us**
- **Foster learning environment by encouraging risk taking**
- **Build a learning relationship, together like an living organism**
- **Practice life-long learning**

Strive for becoming the best company, “organization” one would want to work for.

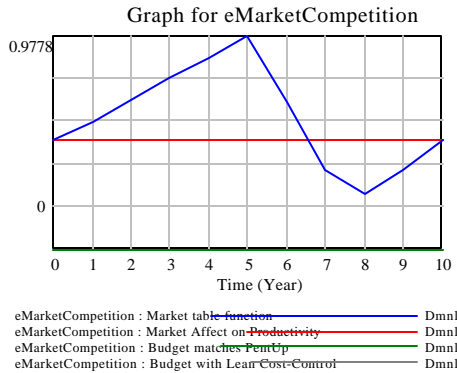
External Forces at work

External forces affect us, we're also part of a system, influence back.



How do we survive in the Corporate Storm – balancing in the complex World of Dynamics today and prepare for a higher complexity World of tomorrow?

Market Competition Affect Analysis



Market table function —
 Market Affect on Productivity —
 Budget matches PentUp —
 Budget with Lean Cost-Control —

iWorkInProgress

129,760

WorkUnit

15,000

iStatementOfWork

24,021

WorkUnit/Year

8,812

iWorkComplete

23,475

WorkUnit/Year

5,170

Time (Year)

Market table function —
 Market Affect on Productivity —
 Budget matches PentUp —
 Budget with Lean Cost-Control —

fBudget

23.47 M

Dollar/Year

6.609 M

cPentUpDemands

15,975

WorkUnit/Year

1,312

fBudgetDiscrepancy

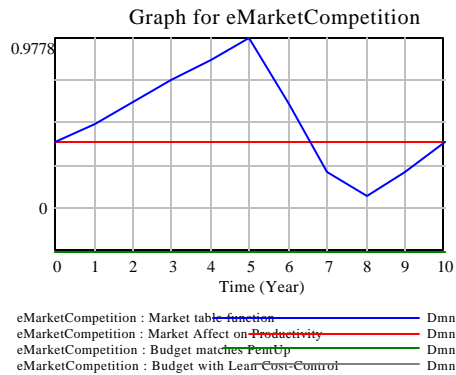
0.25

Fraction

0

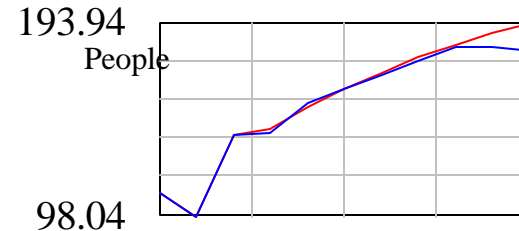
Time (Year)

Market Competition Affect Analysis (cont.)

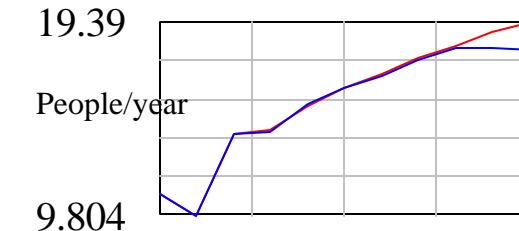


Market table function —
 Market Affect on Productivity —
 Budget matches PentUp —
 Budget with Lean Cost-Control —

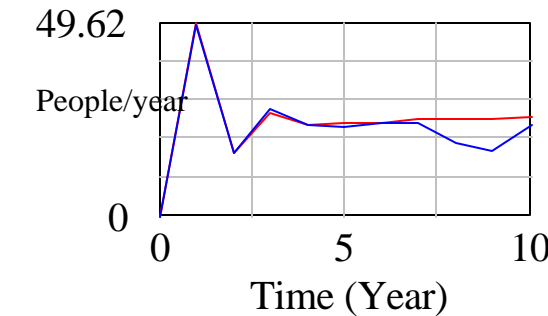
lgWorkforce



lgAttrition

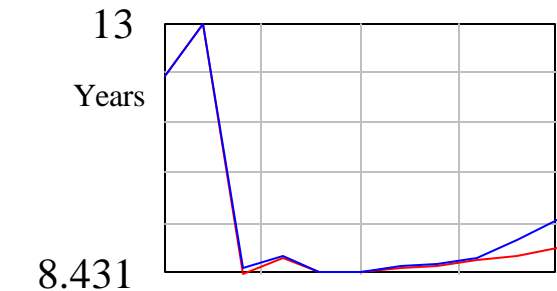


lgHiring

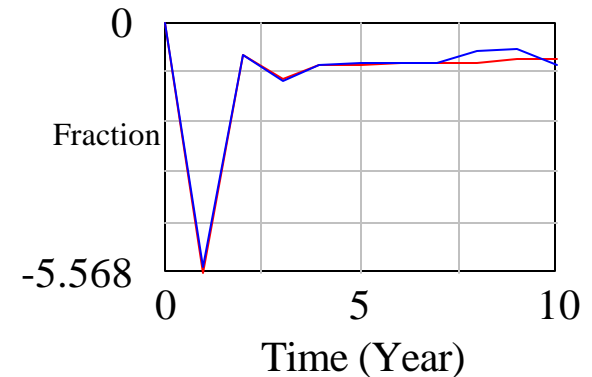


Market table function —
 Market Affect on Productivity —
 Budget matches PentUp —
 Budget with Lean Cost-Control —

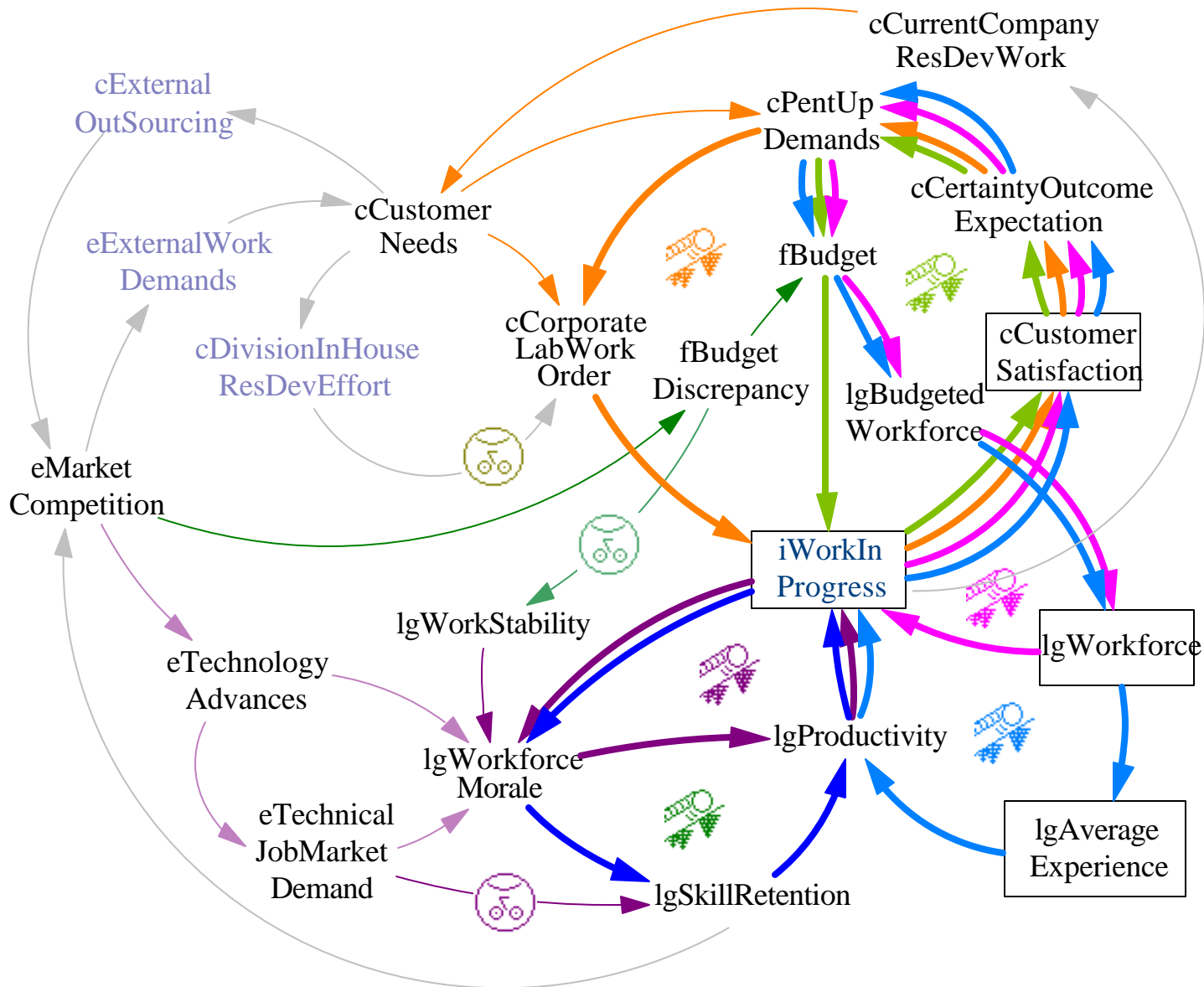
lgAverageExperience



lgChangeInAverageExperience



Summary of The Causal Dynamics



Recommendations

Momentum Hypotheses

- Work with divisional (customers) VPs for their needs
- Prioritize resource with customer
- Build customer relationships
- Achieve high customer satisfaction
- Budget for certainty outcome
- Budget for customer's investment
- Allocate budget against IR&D

- Understand employee dynamics

- Build closer workforce relationship

New Policies

- Understand the affect of pent-up demand affect on work loads
- Manage customer expectations
- Mutually understand and agree on work statement outcome expectations
- Match budget with pent-up demands
- Reconnect, strengthen and make visible the link between Budget and Work Order
- No more the "Good Guy" favors!
- Maintain a stable workforce environment
- Minimize impacts of market competition on work force fluctuations
- Focus on stimulating technical challenges and innovations
- Eliminate and unlearn rules and regulations that no longer serve us
- Foster learning by encouraging risk taking
- Build a learning relationship, working together like an living organism
- Practice life-long learning