Rethinking your supply chain strategy in complex markets

November 14, 2012 - MIT CTL Advances in Supply Chain Management Webinar Series

Dr Roberto Perez-Franco
Director
Supply Chain 2020 Project
Collaborative management research: an alliance between academics and practitioners

Source: Reddit. Trying to identify the author. If you have info, please let me know, so that I can credit him or her properly. Thanks.
A bit of theory on complex problems
The **objective complexity** of a system is proportional to things like:

- the number of elements in the system,
- the number of their possible states, and
- the number of relationships between them.
Subjective complexity

The **subjective complexity** of a system is determined by its objective complexity, but also by our capacity or **ability to understand** the system, and the **time pressure** exerted upon us to make a decision.

Adapted from Dorner (1983) – Heuristics and cognition in complex systems

Photos: Kasparov - Owen Williams, The Kasparov Agency.
Clock – The Chess Store
Well-defined problems

Well-defined problems are characterized by the following features:

- The aspired goal state is exactly known with respect to the criteria that must be met.
- The field of reality in which the problem is found is precisely known.

To keep them easily accessible to formal treatments (i.e. computer simulation), these problems are often:
- limited to static objects,
- limited to objects that are not very complex, and
- limited to completely transparent objects whose characteristics are evident and easily conceivable.
The “other types” of problems

There are other types of problems, more common in daily life, which place other demands on us. It is frequently the case with these other problems that:

• The goal criteria are vague, and one is not at all certain what the aspired goal state is to be like.
• There are conflicts between goals, due to the contradictory relationships between partial goals.
• There is a lack of knowledge as to the possible operators and possible states of the system.
• It is often necessary to act with incomplete, inexact and/or incorrect information.

Source: Dorner (1983) – Heuristics and cognition in complex systems

Photo: Mining Technology
We can’t eliminate complexity. **But we can tame it.**

**Rx:** Reduce the objective complexity of the system

**Rx:** Increase our ability to understand the system

**Rx:** Reduce time pressure in decision making

**Rx:** Clearly specify the desired end state

**Rx:** Tend to conflicts between partial goals

**Rx:** Increase our knowledge about the structure of the system

**Rx:** Get more complete information

Source: Wikimedia Commons - (CC) BY - Robek
What a happy lion! Source: © kjdrill – All rights reserved
Outline of the SC2020 approach to rethinking your SCS
A pragmatic way to think about SCS

Source: Perez-Franco / SC2020 Project
A pragmatic way to think about SCS

Operational Practices

Supply Chain Strategy

Business Strategy

Pillars

C

Imperatives

Principles

Policies

Operational Practices

Source: Perez-Franco / SC2020 Project
A working definition of supply chain strategy

The supply chain strategy of a business unit can be defined as the collection of supply chain relevant (SCR) imperatives, principles and policies that serve as the logical bridge between the business strategy and the operational practices of the business unit’s supply chain.

Source: Perez-Franco / SC2020 Project
Conceptual elements and the strategy-operations continuum

Strategic in focus | Abstract in nature | Wider in scope | Statement of Purpose
--- | --- | --- | ---
Operational in focus | Concrete in nature | Narrower in scope | Statement of Practice

Source: Perez-Franco / SC2020 Project
The working model

- Driving Forces
- Local Factors
- Parent Organization

- Assets
- Imperatives
- Principles
- Policies
- Operational Practices
- Capabilities

Source: Perez-Franco / SC2020 Project
Fundamental tasks in rethinking a supply chain strategy
Task #1: Scoping, along the axes of complexity involved in rethinking a supply chain strategy

Source: Perez-Franco / SC2020 Project
Task #2: Visioning
Thinking about alternative future scenarios

Source: Perez-Franco / SC2020 Project
Task #3: Specification

Source: Perez-Franco / SC2020 Project
## Task #5: Evaluation

**Must-have evaluation criteria**

### Criteria 1: Support

Every concept is **expected** to provide support to at least one concept from the layer above its own.

### Criteria 2: Compatibility

Every concept is **expected** to be compatible with every other concept within the same layer.

### Criteria 3: Feasibility

Every concept is **expected** to be feasible (e.g. realizable) through concepts in the layers below it.

---

Source: Perez-Franco / SC2020 Project
Good-to-have evaluation criteria

Criteria 4: Coverage

Taken together, the collection of concepts within a layer **should** address all the areas of interest for that level of abstraction.

Criteria 5: Sufficiency

Every concept **should** be fully satisfied by the collective support it receives from concepts in levels under it.

Source: Perez-Franco / SC2020 Project
*Nice-to-have* evaluation criteria

**Criteria 6: Synergy**

It is **desirable** for a concept to have mutually beneficial relationships, and to **not** have mutually detrimental relationships, with other concepts within its layer.

**Criteria 7: Parsimony**

It is **desirable** for a concept to make better use of the resources it takes, in terms of producing results.
**Tasks #6 and #7: SCS Formulation** through progressive conceptual system assembly (PCSA)

### Task #7: System Assembly

<table>
<thead>
<tr>
<th>AREA</th>
<th>IMP</th>
<th>Imperative</th>
<th>IMP</th>
<th>Imperative</th>
<th>IMP</th>
<th>Imperative</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRI</td>
<td>Principle</td>
<td>Principle</td>
<td>Principle</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>POL</td>
<td>Policy</td>
<td>Policy</td>
<td>Policy</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OPE</td>
<td>Practice</td>
<td>Practice</td>
<td>Practice</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Areas of Interest

- \( A_1 \)
- \( A_2 \)
- ... \( A_{N-1} \)
- \( A_N \)

**Task #6: Concept Generation**

Source: Perez-Franco / SC2020 Project
Example of an ongoing PCSA (progressive conceptual system assembly)

Area 1: Service
1. Ensure high delivery reliability
   1a. Better understand customer needs
   1b. Define customer segments
   1c. Proactively procure and reserve transport capacity on a forecast basis

Area 2: Cost
2. Lower our transportation costs
   2a. Procure transportation services at the corporate level
   2b. Revise our transportation contracts annually

Area 3: Assets
3. Work towards lower stock levels
   3a. Better understand the customer needs
   3b. Manage inventory levels based on demand forecast

Source: Perez-Franco / SC2020 Project
Task #8: Implementation

Source: Perez-Franco / SC2020 Project
Sequencing the tasks: Rethinking the supply chain strategy of a business unit for the middle term

Source: Perez-Franco / SC2020 Project
HOW OUR APPROACH HELPS TAME THE COMPLEXITY OF RETHINKING YOUR SCS
Rx

Reduce the objective complexity of the system

*Scoping* allows us to focus on a part of the supply chain whose objective complexity we can handle.
Rx

Increase our knowledge about the structure of the system

Our *working model* of SCS helps you understand better the structure of the SCS and its context.
Rx
Get more complete information

Articulation and evaluation help us to get more complete information about the current state.

Visioning helps us get more information about the future.
Rx

Reduce the time pressure in decision making

*Visioning* helps us anticipate the effects of future events, and prepares us to react faster to change.
Rx

Clearly specify the desired end state

*Specification* allows us to define, through a set of clear goals, what success looks like for our SCS.
**Rx**

Tend to conflicts between partial goals

*PCSA helps us reformulate an improved SCS, while promoting compatibility and synergy among the elements.*
Rx
Increase our ability to understand the system

In general, the SC2020 approach to rethinking a SCS helps you to better understand the SCS as a system.
Thanks for your time

I will be happy to take any questions at this time
Join CTL

December 4, 2012 – Dr Yossi Sheffi Book Launch and Signing Event – MIT Media Lab -5:30 –7:00 PM


Questions about the CTL Supply Chain Exchange? Contact Bob Vaz – rvaz@mit.edu
http://ctl.mit.edu
Back-up slides
General Expectations

- **Grow with the key markets**
  - Retain market share in existing markets
  - Win in the photovoltaic market
  - Prepare for long-term threats to the industry

- **Increase our margins**
  - Reduce operative costs
  - Grow ‘Spread’
  - Optimize the match of customers and products

- **Commit fully to safety and quality**
  - Deliver exceptional products
  - Deliver exceptional service
  - ‘Own Quality’

Functional Expectations

- **Customer Service:**
  - Meet all (e.g., >99%) commitments to customers flawlessly

- **Manufacturing:**
  - Improve processes to reduce the cost of manufacturing

- **Procurement:**
  - Manage the cost of raw materials and other supplies

- **Supply Chain:**
  - Achieve lowest delivered costs position in all world areas

- **Innovation:**
  - Focus innovation on high-impact process improvements and high-margin new products

- **Photovoltaic:**
  - Offer superior products and technical support

Source: Perez-Franco / SC2020 Project
Sample of a within-level evaluation matrix

<table>
<thead>
<tr>
<th></th>
<th>FT1</th>
<th>FT2</th>
<th>FT3</th>
<th>FT4</th>
<th>FT5</th>
<th>FT6</th>
<th>FT7</th>
<th>FT8</th>
</tr>
</thead>
<tbody>
<tr>
<td>FT1</td>
<td></td>
<td>0.6</td>
<td>1.4</td>
<td>-0.1</td>
<td>0.4</td>
<td>-0.4</td>
<td>1.4</td>
<td>0.4</td>
</tr>
<tr>
<td>FT2</td>
<td>0.5</td>
<td></td>
<td>0.4</td>
<td>-0.5</td>
<td>0.3</td>
<td>-0.2</td>
<td>0.9</td>
<td>1.1</td>
</tr>
<tr>
<td>FT3</td>
<td>0.0</td>
<td>0.3</td>
<td></td>
<td>0.4</td>
<td>0.4</td>
<td>0.8</td>
<td>1.2</td>
<td>0.4</td>
</tr>
<tr>
<td>FT4</td>
<td>-0.1</td>
<td>-0.8</td>
<td>2.2</td>
<td></td>
<td>-0.8</td>
<td>-1.2</td>
<td>1.9</td>
<td>1.8</td>
</tr>
<tr>
<td>FT5</td>
<td>3.0</td>
<td>1.8</td>
<td>1.3</td>
<td>-0.9</td>
<td></td>
<td>0.2</td>
<td>1.7</td>
<td>1.0</td>
</tr>
<tr>
<td>FT6</td>
<td>2.1</td>
<td>-1.1</td>
<td>1.1</td>
<td>-1.3</td>
<td>0.3</td>
<td></td>
<td>1.6</td>
<td>0.4</td>
</tr>
<tr>
<td>FT7</td>
<td>0.0</td>
<td>0.0</td>
<td>1.6</td>
<td>0.4</td>
<td>0.0</td>
<td>0.0</td>
<td></td>
<td>0.3</td>
</tr>
<tr>
<td>FT8</td>
<td>0.1</td>
<td>0.5</td>
<td>1.8</td>
<td>1.0</td>
<td>-0.3</td>
<td>0.0</td>
<td>0.4</td>
<td></td>
</tr>
</tbody>
</table>

Source: Perez-Franco / SC2020 Project
Reciprocal conflicts we found in a project

FT5: Achieve the lowest delivered cost (a.k.a. ST3)

FT2: Manufacture in high volume plants

FT6: Operate with the lowest working capital

FT4: Deliver best-in-class service

Source: Perez-Franco / SC2020 Project
How to formulate a new SC strategy for the long term?

Start

Scoping

Visioning

Scenario 1

Specification for Scenario 1

Concept Generation for Scenario 1

Scenario 2

Specification for Scenario 2

Concept Generation for Scenario 2

Scenario 3

Specification for Scenario 3

Concept Generation for Scenario 3

Group concepts by robust and contingent

System Assembly

Implementation

Monitoring

End*

Source: Perez-Franco / SC2020 Project