PCN Diagrams:
A new tool for service design and innovation

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BYU Business Management Department Seminar (August 20, 2010)
London Service Science Forum (September 16, 2010)
Bath, UK EurOMA Service OM Forum (September 20-21, 2010)
Cambridge International Manufacturing Management Symposium (September 24, 2010)
San Diego Decision Sciences Institute Meeting (November 23, 2010)
Outline

1. Problems with service design and innovation
2. Tools for service design
3. Service strategy and innovation
1. Problems with service design and innovation
Experts say...

“...innovation in services is less disciplined and less creative than in the manufacturing and technology sectors.”

“A recent comprehensive review of the academic literature on product innovation also reveals little explicit coverage of research on service innovation.”

“...lack of widespread and disciplined innovation in services derives at least partially from the nature of services themselves.”

Service design and innovation sucks!

The design of new services “remains among the least studied and understood topics in the service management literature despite the plethora of rigorous research and models on product development, especially in recent years.” (Menor, Tatikonda, and Sampson 2002)

Design and innovation: Who, Where, and What…
2. Tools for service design
Service design tools

- Services are processes

Process design tools:
1. Process Flowcharts
2. Service Blueprints
3. Supply Chain Diagrams
4. Process-Chain-Network Diagrams
Tool 4. Process-Chain-Network (PCN) Diagrams

- a new tool
- document processes
- documents interactions
- documents networks
- facilitates strategy and innovation
Process Chains
What is a process?

Sequence of dependent steps
What is a process?

Sequence of dependent steps

- forecast supply needs
- identify ingredients
- develop recipes
- preheat ovens
- cook pizza
- take order
- serve pizza
- maintain supplies
- receive supplies online
- order supplies online
- negotiate supply contract
What is a process?

Sequence of dependent steps

Process Step (action verb and object noun)
- negotiate supply contract
- order supplies online
- receive supplies
- identify ingredients
- forecast supply needs
- develop recipes
- preheat ovens

Precedence relationship (implies a required resource state)
- cook pizza
- serve pizza
- take order
- maintain supplies
- receive supplies
- order supplies online
- identify ingredients
- forecast supply needs
- develop recipes
- preheat ovens
- cook pizza
Process Entity

An entity’s *Process Domain* includes all processes that are directly performed by the entity.
Process Entity example

Pizza Restaurant
Restaurant's Process Domain
Process Entity example

Pizza Restaurant
Restaurant’s Process Domain

- order supply needs
- forecast supply needs
- identify ingredients
- develop recipes
- preheat ovens
- cook pizza
- take order
- serve pizza
- receive supplies
- negotiate supply contract
- maintain supplies
Three regions of a Process Domain

Pizza Restaurant

Restaurant's Process Domain

**Direct interaction** (e.g. with supplier)
- Negotiate supply contract
- Order supplies online
- Receive supplies

**Surrogate interaction** (e.g. acting on supplier resources)
- Identify ingredients
- Forecast supply needs
- Maintain supplies

**Independent processing** (entity acting on entity's owned/controlled resources)
- Develop recipes
- Preheat ovens
- Cook pizza

**Surrogate interaction** (e.g. acting on customer resources)
- Take order

**Direct interaction** (e.g. with customer)
- Serve pizza

Example:
- Forecast supply needs
- Order supplies online
- Receive supplies
- Negotiate supply contract
- Develop recipes
- Preheat ovens
- Cook pizza
- Take order
- Serve pizza

Example:
- Forecast supply needs
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Three regions of a Process Domain

Pizza Restaurant
Restaurant's Process Domain

Direct interaction

Surrogate interaction

Independent processing

Surrogate interaction

Direct interaction

- negotiate supply contract
- identify ingredients
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- take order
- cook pizza
Three regions of a Process Domain

1. Direct Interaction
Entity person acting in conjunction with another entity person.
People with people.

2. Surrogate Interaction
Entity person acting on/with resource(s) of another entity.
People with things (belongings, information).

3. Independent Processing
Entity acting only on/with entity’s own resources.
Three regions of a Process Domain

1. Direct Interaction
Entity person acting in conjunction with another entity person.
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Entity acting only on/with entity’s own resources.

Underlying assumptions:
- People are process initiators (“operant resources”).
- Things (belongings, information) are objects of processing (“operand resources”).

Limitations:
- No representation of things autonomously acting on things.
  - automatic car wash?
  - auto bill-pay?
- Questions the existence of things acting on people (versus people using things to act on themselves).
Process Chain Networks
What is a Process Chain Network?

a network of interdependent process chains that span multiple process entities.
Interdependent Process Chains

Pizza Restaurant

Restaurant’s Process Domain

Direct interaction | Surrogate interaction | Independent processing | Surrogate interaction | Direct interaction

- negotiate supply contract
- foretell supply needs
- order supplies online
- receive supplies
- identify ingredients
- develop recipes
- preheat ovens
- maintain supplies
- cook pizza
- serve pizza
- create
- seat customer
- prepare check
- present check
- eat
- return home
- wait to be seated
- seat customer
- review menu
- present check
- pay check
- eat leftovers
- wait for pizza
- fill order
- maintain supplies
Process-Chain-Netwrok (PCN) Diagram

PCN Diagrams can span an unlimited number of entities.

- Health Clinic
  - Dir.
  - Sur.
  - Ind.
  - Sur.
  - Dir.
  - train staff on tools
  - clean lab tools
  - submit payment claim
  - submit prescription to pharmacy
  - take blood
  - prescribe medication
  - take medication

- Patient
  - Dir.
  - Sur.
  - Ind.
  - Sur.
  - Dir.
  - pay covered amount
  - develop payment schedule
  - develop medication coverage agreement
  - submit payment claim
  - get pmt
  - fill prescription
  - check coverage

- Insurance Company
  - Dir.
  - Sur.
  - Ind.
  - Sur.
  - Dir.
  - review claim
  - process payment
  - submit payment claim
  - review claim

- Pharmacy
  - Dir.
  - Sur.
  - Ind.
  - Sur.
  - Dir.
  - analyze blood
  - procure lab tools
  - clean lab tools
  - submit payment claim

Sampson PCN Diagrams © 2011
PCN Analysis
Process steps span different regions

“Supplier”

Pizza Restaurant

<table>
<thead>
<tr>
<th>Independent processing</th>
<th>Surrogate interaction</th>
<th>Direct interaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>develop recipes</td>
<td>preheat ovens</td>
<td>cook pizza</td>
</tr>
<tr>
<td></td>
<td>maintain supplies</td>
<td></td>
</tr>
</tbody>
</table>

“Customer”

Pizza Consumer

<table>
<thead>
<tr>
<th>Direct interaction</th>
<th>Surrogate interaction</th>
<th>Independent processing</th>
</tr>
</thead>
<tbody>
<tr>
<td>seat customer</td>
<td>wait to be seated</td>
<td>develop appetite</td>
</tr>
<tr>
<td>create order</td>
<td>review menu</td>
<td></td>
</tr>
<tr>
<td>serve pizza</td>
<td>wait for pizza</td>
<td></td>
</tr>
<tr>
<td>eat pizza</td>
<td>present check</td>
<td></td>
</tr>
<tr>
<td>pay check</td>
<td>return home</td>
<td></td>
</tr>
<tr>
<td>prepare check</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Pizza Restaurant: Independent processing, preheat ovens, maintain supplies, develop recipes, cook pizza
- Pizza Consumer: seat customer, create order, serve pizza, eat pizza, pay check, return home, wait for pizza, present check, review menu, wait to be seated, develop appetite

Developments:
- Pizza Restaurant: develop recipes, preheat ovens, maintain supplies
- Pizza Consumer: seat customer, create order, serve pizza, eat pizza, pay check, return home, wait for pizza, present check, review menu, wait to be seated, develop appetite
**P-C-N depictions of service concepts**

- **“Supplier”**
  - Pizza Restaurant
    - Independent processing
    - Surrogate interaction
    - Direct interaction
  - “Support” process steps
    - “back-office” process steps
    - “Do it yourself” process steps
  - Surrogate influence on customer processes

- **“Customer”**
  - Pizza Consumer
    - Independent processing
    - Surrogate interaction
    - Direct interaction
  - “Do it yourself” process steps
    - “Self-service” process steps
    - “Co-production” (customer labor)
  - Surrogate influence on customer processes

**Service process steps**

- “Service” process steps
  - “customer contact”
    - “Front-stage” process steps
    - “Self-service”
  - “Support” process steps
    - “back-office” process steps
    - “Do it yourself” process steps

**Notes:**
- Develop appetite
- Maintain supplies
- Serve pizza
- Preheat ovens
- Create order
- Review menu
- Seat customer
- Present check
- Prepare check
- Pay check
- Eat leftovers
- Wait for pizza
- Wait to be seated
- Develop recipes
- Surrogate influence on customer processes
- Direct influence on customer processes
- Independent processing
- Back-office influence on customer processes
- Self-service influence on customer processes
- Co-production influence on customer processes
Customer Intensity

“Supplier”

Pizza Restaurant

- Independent processing
- Surrogate interaction
- Direct interaction

“Customer”

Pizza Consumer

- Independent processing
- Surrogate interaction
- Direct interaction

“service” process steps have high Customer Intensity

“Customer Intensity”

- develop appetite
- independent process steps have low Customer Intensity

- maintain supplies
- serve pizza
- eat pizza
- return home
- pay check
- present check
- serve pizza
- create order
- review menu
- wait for pizza
- eat pizza

- preheat ovens
- review menu
- create order
- serve pizza
- pay check
- present check
- serve pizza
- eat pizza
- return home
What is Customer Intensity?

A relationship between customer and the provider’s process…

“The degree to which variation coming from customers causes variation in the firm’s processes.” (Sampson 2010)

The degree of influence individual customers have on the design and execution of firm processes.

Low Customer Intensity
Customer variation has little impact on variation in the process step.
e.g. baking bread

High Customer Intensity
Customer variation has big impact on variation in the process step.
e.g. selling bakery items
# Why do we care about Customer Intensity?

<table>
<thead>
<tr>
<th>Design Factor</th>
<th>Low Customer Intensity</th>
<th>High Customer Intensity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Facility layout</td>
<td>Organized to enhance process flow.</td>
<td>Accommodate customer needs and expectations.</td>
</tr>
<tr>
<td>Worker skills</td>
<td>Focus on efficiency and consistency. Trained.</td>
<td>Focus on interaction skills and responsiveness.</td>
</tr>
<tr>
<td>Job design</td>
<td>Tightly defined with precise steps and cycle time.</td>
<td>Broadly defined.</td>
</tr>
<tr>
<td>Sales opportunity</td>
<td>Mass marketing.</td>
<td>Personal selling.</td>
</tr>
<tr>
<td>Quality control</td>
<td>Based on formal specifications.</td>
<td>Based on variable standards from customers.</td>
</tr>
<tr>
<td>Asset utilization</td>
<td>Schedule assets for maximum utilization (ROI).</td>
<td>Balance asset utilization with customer responsiveness.</td>
</tr>
<tr>
<td>Use of technology</td>
<td>Cost/productivity issues dominate.</td>
<td>Customer acceptance issues dominate.</td>
</tr>
<tr>
<td>Economies of scale</td>
<td>Key to cost effectiveness.</td>
<td>Limited by variation in customer requirements/resources.</td>
</tr>
</tbody>
</table>
Facility layout: aesthetic.
Worker skills: domain experts.
Job design: broad.
Sales opportunity: personal.

Quality control: experiential.
Asset utilization: low.
Use of technology: limited.
Economies of scale: low.
Buying furniture at IKEA

Facility layout: functional.
Worker skills: trained.
Job design: tight.
Sales opportunity: mass marketing.

Quality control: engineered.
Asset utilization: high.
Use of technology: extensive.
Economies of scale: high.
3. Service strategy and innovation

Enabling and Relieving
Servitization and Deservitization
Principles of Process-Chain Innovation

1. Customer Intensity is a strategic choice!
1. Customer Intensity is a strategic choice

**Sandwich Supplier**
Supplier’s Process Domain

- **Independent processing**
  - assemble prepackaged sandwich in a factory for sale at grocery store

- **Surrogate interaction**
  - assemble sandwich to order in restaurant kitchen

**Sandwich Consumer**
Consumer’s Process Domain

- **Independent processing**
  - assemble sandwich at home using ingredients from the refrigerator

- **Surrogate interaction**
  - assemble sandwich at a buffet restaurant

- **Direct interaction**
  - assemble sandwich at a Subway sandwich as customer selects orders
Principles of Process-Chain Innovation

1. Customer Intensity is a strategic choice!
2. Process positioning makes a difference!
Which is the best process positioning?

Sandwich Supplier

Supplier’s Process Domain

**Independent processing**
- assemble prepackaged sandwich in a factory for sale at grocery store

**Surrogate interaction**
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Sandwich Consumer

Consumer’s Process Domain

**Independent processing**
- assemble sandwich at home using ingredients from the refrigerator

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- assemble sandwich at a buffet restaurant

**Direct interaction**
- assemble sandwich to order in restaurant kitchen

Which is the best process positioning?

- Assemble prepackaged sandwich in a factory for sale at grocery store
- Assemble sandwich to order in restaurant kitchen
- Assemble sandwich at a Subway sandwich as customer selects orders
- Assemble sandwich at home using ingredients from the refrigerator

Principle #1: Process inefficiency

Principle #2: Customization

Principle #3: Economies of scale

Principle #4: Surrogate
Principles of Process-Chain Innovation

1. Customer Intensity is a strategic choice!
2. Process positioning makes a difference!
3. Enabling innovations move process steps toward customers.
4. Relieving innovations move process steps away from customers.
Take-and-bake pizza Process Chain

"Supplier"

**Take & Bake Pizza**

- Independent processing
- Surrogate interaction
- Direct interaction

- develop recipes
- preheat ovens
- prepare components
- maintain supplies
- assemble pizza
- wrap pizza
- pay for pizza
- call restaurant
- discuss options and specials
- place order
- travel to store
- eat leftovers
- eat pizza
- cook pizza
- travel home

"Customer"

**Pizza Consumer**

- Independent processing
- Direct interaction
- Surrogate interaction

- develop appetite
- travel to store
- eat pizza
- cook pizza
- travel home
Enabling innovation?

“enabling” innovations move process steps towards customers

Take & Bake Pizza

- Independent processing
- Surrogate interaction
- Direct interaction

- develop recipes
- preheat ovens
- prepare components
- maintain supplies

- assemble pizza
- wrap pizza
- pay for pizza

Pizza Consumer

- Direct interaction
- Surrogate interaction
- Independent processing

- develop appetite
- eat leftovers
- eat pizza
- cook pizza
- travel home

- work
- play

- call restaurant
- discuss options and specials
- place order
- travel to store
- eat pizza
- travel home
- eat leftovers
- cook pizza
- place order
- discuss options and specials
- call restaurant

“Supplier”

“Customer”
Enabling innovation: pizza order phone app

“enabling” innovations move process steps towards customers

Take & Bake Pizza

- Independent processing
  - develop recipes
  - preheat ovens
  - prepare components
  - maintain supplies
  - assemble pizza
   - wrap pizza
   - pay for pizza

Pizza Consumer

- Direct interaction
  - call restaurant
  - discuss options and specials
  - place order
    - travel to store
    - eat leftovers
    - eat pizza
    - cook pizza
    - travel home
- Surrogate interaction
  - place order on mobile phone app
- Independent processing
  - develop appetite

The NEW Pizza Hut iPhone App

“Supplier”

“Customer”
Relieving innovation?

“relieving” innovations move process steps away from customers

“Supplier”

Take & Bake Pizza

- Independent processing
- Surrogate interaction
- Direct interaction

“Customer”

Pizza Consumer

- Independent processing
- Surrogate interaction
- Direct interaction

- Develop appetite
- Eat leftovers
- Eat pizza
- Cook pizza
- Travel home

- Travel to store
- Place order
- Discuss options and specials
- Call restaurant

- Pay for pizza
- Wrap pizza
- Assemble pizza
- Preheat ovens
- Maintain supplies
- Develop recipes
- Prepare components
Relieving innovation: autopay & porch delivery

“relieving” innovations move process steps away from customers

“Supplier”

Take & Bake Pizza

- Independent processing
- Surrogate interaction
- Direct interaction

- develop recipes
- preheat ovens
- prepare components
- maintain supplies
- assemble pizza
- wrap pizza
- deduct from customer account
- place pizza in customer's porch box

“Customer”

Pizza Consumer

- call restaurant
- discuss options and specials
- place order
- travel to store
- pay for pizza

- develop appetite
- eat leftovers
- eat pizza
- cook pizza
- travel home
- travel to store
- place order
- discuss options and specials
- call restaurant

Relieving innovation: autopay & porch delivery

“relieving” innovations move process steps away from customers

“Supplier”

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- call restaurant
Summary

An important new service design tool…

PCN Diagrams (aka Sampson Diagrams)

• Can document multi-entity process networks.
• Can capture interrelationships between firm processes and customer processes.
• Can reveal opportunities for process innovation.

Examples:
• Airline travel
• Mobile phone purchase
• Industrial laundry