The industrialization of the operating room supply chain

Sylvain Landry, Ph.D.
Professor and Associate Director
Healthcare Management Hub
HEC Montréal
University Partner, Logi-D

Richard Philippe
Founder and CEO
Logi-D

April 2012
Dr. Landry is a Full Professor and Associate Director of the Healthcare Management Hub at HEC Montréal.

He is also an Affiliated Professor at BEM (Bordeaux Management School, France), a member of the AHRMM Academic Council, and a member of the scientific review committees for *Logistique & Management*, *Supply Chain Forum: An International Journal*, and *International Journal of Health Management and Information*.

Dr. Landry has observed logistics practices in hospitals around the world.

He has also authored numerous articles and has spoken on this topic at many conferences.
HEC Montréal

- 39 management study programs
- 50 research chairs, groups and centers
- 250 career professors and 400+ part time lecturers
- 3 teaching languages
  - French, English and some Spanish
- 12 000 students (6 000 full-time) from 60 countries
- 65 000+ graduates (alumni)
- International rankings
Richard Philippe

Richard Philippe is the founder and CEO of Logi-D Inc., a leading provider of innovative hospital supply chain automation solutions.

With more than 25 years’ experience in the healthcare sector, Mr. Philippe has spoken a number of times at conferences in Canada, the United States, Europe and Asia.

He has contributed to the development and been a lecturer for a course on Japanese management models for APICS; an operations management course at the HEC Montréal business school; and a hospital logistics course and a course on applying a lean approach in the healthcare sector for the HEC Montréal Executive Education program.

He is also a founding board member of the Healthcare Supply Chain Network, the Canadian chapter of AHRMM.
Logi-D

- Logi-D is a developer and supplier of supply chain automation solutions for the hospital sector.
- We offer an innovative solutions platform that features leading-edge practices and technologies, such as lean, voice and RFID, adapted from industry specifically for application in the healthcare field.
- We draw on our in-depth sector knowledge, extensive hospital material management consulting experience, and supply chain research affiliation with business schools.
Why do a presentation on *The industrialization of the operating room supply chain*?
Why the supply chain?

Supply chain costs: 55%

- Clinical & other labor: 45%
- Consumables: 25%
- Logistics & distribution: 15%
- Other services: 15%

Source: HFMA, 2009
Why supply chain industrialization?

Clinical vs Industrial

- 1st Time Order Accuracy: 98% (Clinical) vs 78.8% (Industrial)
- Lines/Order: 10 (Clinical) vs 1.5 (Industrial)
- Turns: 10 (Clinical) vs 2.1x (Industrial)
- Expiration: 0.02% (Clinical) vs 5% (Industrial)
- EDI%: 95% (Clinical) vs 25% (Industrial)
- Charge Capture: 100% (Clinical) vs 75% (Industrial)

Source: Sample of O&M customers

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### Why the OR?

<table>
<thead>
<tr>
<th></th>
<th>0-49 beds</th>
<th>50-59 beds</th>
<th>100-199 beds</th>
<th>200-299 beds</th>
<th>300-399 beds</th>
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<th>500+ beds</th>
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<td>4.6</td>
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<tr>
<td>400-499 beds</td>
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<td>500+ beds</td>
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<td>13.1</td>
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Agenda

- Industrialization of services/healthcare: background information
- Industrialization: examples of technologies and practices used in the healthcare supply chain
- Case studies in the OR: integrating soft and hard technologies
Agenda

• **Industrialization of services/healthcare: background information**
• Industrialization: examples of technologies and practices used in the healthcare supply chain
• Case studies in the OR: integrating soft and hard technologies
Scientific management and the industrialization of healthcare: the origins

- 1910
  - F.W. Taylor
  - Henry Ford

- 1920
  - F. Gilbreth
  - E.A. Codman
  - R.L. Dickinson

- 1930
  - TWI
    - Training Within Industry

- 1940
  - E. Toyoda
  - T. Ohno

- 1950
  - Industrialization of service

- 1970

- 2010
Industrialization of service: a definition

• “In order to drastically improve the quality and efficiency of services, managers of service organizations must consider aspects of their operations where manufacturing concepts could be used; industrialization could then be achieved using hard and soft technologies.”

• In this context, we can define “industrialization” as the application of manufacturing concepts and techniques to services.

Industrialization of healthcare?

“The industrialization of healthcare is the only way to humanize healthcare.”

Markus Froehling, MD
Agenda

• Industrialization of services/healthcare: background information
• **Industrialization: examples of technologies and practices used in the healthcare supply chain**
• Case studies in the OR: integrating soft and hard technologies
Industrialization of service: the technologies

- **Soft technologies**
  - Lean approach to process improvements
    - Standardization
    - Inventory management
    - Visual management
    - Quality management
    - Etc.
  - Activity based costing
- **Hard technologies**
  - Material requirements planning using bills of materials
  - Automation
  - RFID
  - Voice recognition
Industrialization of service: **the technologies**

- **Soft technologies**
  - Lean approach to process improvements
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    - Etc.
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- **Hard technologies**
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Lean healthcare: a definition

A quality and process improvement management system based on the Toyota Production System that emphasizes customer needs, quality improvement, and reducing time delays and costs through continuous improvement and employee involvement.

Adapted from Graban, Lean Hospitals, 2009
Toyota Production System (TPS)

Objectives
- Safety
- Quality
- Morale
- Lead time
- Costs

Teamwork
- Eliminate waste
- (Right part, right quantity, right time)
- JUST IN TIME

Kaizen
- (Quality at the source)
- JIDOKA

Stable and standardized processes

Visual management

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Toyota Production System (TPS)

Objectives
Safety – Quality
Morale – Lead time - Costs

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Kaizen

JIDOKA
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Visual management

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“What is the best way to do a thing? It is the sum of all the good ways we have discovered up to the present. [...] Today’s best, which superseded yesterday’s, will be superseded by tomorrow’s best [...] Today’s standardization [...] is the necessary foundation on which tomorrow’s improvement will be based.”


“In the ordinary hospital the nurses make many useless steps. More of their time is spent in walking than in caring for the patient. This hospital is designed to save steps. [...] we have tried to eliminate [...] waste motion in the hospital.”

Henry Ford, *My Life and Work*, 1922
TPS: main tools

- **5S** – visual management
- **Kanban**
- **Poka-yoke**
- **Jidoka**
- **SMED**

Objectives

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**Teamwork**

**Kaizen**

**Eliminate waste**

**Stable and standardized processes**

**Visual management**

- To remove all unnecessary objects from the station and ensure it remains neat and tidy
- To implement the necessary discipline in order to have an efficient workstation that self-regulates at all times using guidelines and visual instructions
5S – Visual Management

Sort (Seiri)
Set in order (Seiton)
Shine (Seiso)
Standardize (Seiketsu)
Sustain (Shitsuke)
Visual systems in everyday life
5S in healthcare – S1 sort

Before

After
The meaning of “empty” – S2 set in order

Location of the cart

What goes here if the cart is gone?
What reminds us that the cart goes here?

A border is the first step in identifying the location

When the cart is moved, we know that:
1. The space is empty
2. …but it is usually occupied
3. …so naming the location increases its significance
5S in healthcare – S2 set in order

*RFID receptacle and Medication carts*
5S in healthcare – S2 set in order

Operating rooms

Source: Jean-Marc Legentil, Bell Nordic Inc.
5S in healthcare – S3 shine

Before

After
5S in healthcare – S4 standardize
High density storage system in primary storage location
5S in healthcare – S4 standardize

Mobile carts
5S in healthcare – S5 sustain
TPS: main tools

- **5S** – visual management
- **Kanban**
- **Poka-yoke**
- **Jidoka**
- **SMED**

Objectives:
- Safety
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(Quality at the source)

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**Stable and standardized processes**

**Visual management**

Inventory management method where an empty bin or the card or label attached to it triggers the replenishment process
Kanban in the manufacturing sector
RFID enabled Kanban/two-bin system
TPS: main tools

- **5S** – visual management
- **Kanban**
- **Poka-yoke**
- **Jidoka**
- **SMED**

**Objectives**
- Safety
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**JUST IN TIME**
(Right part, right quantity, right time)

**JIDOKA**
(Quality at the source)

**Teamwork**

**Eliminate waste**

**Stable and standardized processes**

**Visual management**

- Means fool-proof or mistake proofing devices in Japanese
- System that prevents a person or a machine from making a mistake

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Three poka-yoke levels

1. Guide
2. Fence/guard rail
3. Brick wall
Poka-yoke
Poka-yoke in healthcare
TPS: main tools

- **5S** – visual management
- **Kanban**
- **Poka-yoke**
- **Jidoka**
- **SMED**

Objectives

- Safety – Quality
- Morale – Lead time – Costs

**JUST IN TIME**

(Right part, right quantity, right time)

**Kaizen**

(Quality at the source)

**JIDOKA**

Eliminate waste

Teamwork

Stable and standardized processes

Visual management

- Means autonomous control
- Intelligent system that stops an operation if a problem is detected – alert-based
- A worker can stop a procedure if he or she detects that something is wrong
Jidoka in healthcare
TPS: main tools

- **5S** – visual management
- **Kanban**
- **Poka-yoke**
- **Jidoka**
- **SMED**

**Objectives**
- Safety – Quality
- Morale – Lead time – Costs

**JUST IN TIME**
- (Right part, right quantity, right time)
- Quality at the source

**JIDOKA**
- Kaizen
- (Quality at the source)

**Teamwork**

**Eliminate waste**

**Stable and standardized processes**

**Visual management**

- Single Minute Exchange of Dies
- Refers to a technique for performing setup operations in 9 minutes or less
- When adapted to healthcare, it refers to a technique to reduce the time between operations (OR), between X-rays, etc.
SMED in healthcare
Industrialization of service: the technologies

• **Soft technologies**
  • Lean approach to process improvements
    • Standardization
    • Inventory management
    • Visual management
    • Quality management
    • Etc.
  • Activity based costing

• **Hard technologies**
  • Material requirements planning using bills of materials
  • Automation
  • RFID
  • Voice recognition
Bill of materials (BOM) example

Assembly diagram

- Finished product
  - Front legs
    - Cross brace
  - Seat
  - Rear legs
    - Rails
    - Cross brace

Source: Adapted from Stevenson W., Benedetti C., (2001), p 526
## Bill of materials (BOM) in healthcare

<table>
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<th>Age</th>
<th>File</th>
<th>Surgeon</th>
<th>Time</th>
<th>Scheduled procedure</th>
<th>Room</th>
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### Age Schedule

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<th>Surgeon</th>
<th>Time</th>
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<th>Room</th>
</tr>
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<td>68</td>
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#### Preparations

- **Preparation of the Patient**
  - **Aspiration**
    - Plateau: 1 Canules d’aspiration grosse 1
    - Vaseline: 1 Canules d’aspiration fine 1
    - Ampoule ETP 20 ml 1
    - Sonde Foley No 16 ou 18 1
    - Sac à urine 1
    - Seringue 20cc 1

#### Anaesthesia

- **Anaesthetic**
  - Plateau: 2 Cure hernie ing. G + plug 1
  - Vaso-Coll: 1 Canules d’aspiration fine 1
  - Ampoule ETP 20 ml 1
  - Sonde Foley No 16 ou 18 1
  - Sac à urine 1
  - Seringue 20cc 1

#### Surgical Schedule

- **Room**: ABC
- **Surgeon**: Dr. Z
- **Time**: 12:00
- **Scheduled procedure**: Prothèse totale hanche

---

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**Logi-D**

HEC Montréal
Bill of materials (BOM) in healthcare

**Kitting products, using custom packs**

<table>
<thead>
<tr>
<th>Individually packed items</th>
<th>Custom packs</th>
<th>Procedure-based delivery system</th>
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</thead>
<tbody>
<tr>
<td>Individually packed products (100 SKUs)</td>
<td>Individually packed products (50 SKUs)</td>
<td>Individually packed products (10 SKUs)</td>
</tr>
<tr>
<td>Sterilized operation package (1 SKU)</td>
<td>Required supplies (1 SKU)</td>
<td></td>
</tr>
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**Number of SKUs to manage**

- 100
- 51
- 11

**TIME PER PROCEDURE**

- 50 minutes without Custom Pack
- 15 minutes with Custom Pack

- Component selection and transportation 20 minutes
- Setup time 30 minutes
- Setup time 15 minutes
Batch picking using automated storage and retrieval systems and light-directed technologies
Batch picking using automated storage and retrieval systems and light-directed technologies in healthcare
RFID in healthcare

- Asset tracking
- Patient identification
- Surgical safety
- Supply Chain
Management of general supplies using RFID enabled Kanban/two-bin system
Management of supplies that justify individual traceability using RFID-enabled secure cabinets
Management of supplies that justify individual traceability using RFID enabled receptacles
Voice recognition technology

- Speech / voice order picking is listening to and speaking information instead of reading and entering information
Voice recognition technology in healthcare
Agenda

• Industrialization of services/healthcare: background information
• Industrialization: examples of technologies and practices used in the healthcare supply chain
• Case studies in the OR: integrating soft and hard technologies
OR supply chain processes

- Replenishment information flow
- Replenishment physical flow
- Case picking information flow
- Case picking physical flow
Management of predictable items

- Replenishment information flow
- Replenishment physical flow
- Case picking information flow
- Case picking physical flow
Management of unpredictable items
Picking of supplies and charge capture by case

- Replenishment information flow
- Replenishment physical flow
- Case picking information flow
- Case picking physical flow
Case #1 - Picking predictable supplies for multiple cases using carousels

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Measured gains at Pierre-Le Gardeur Hospital

- An average time saving of 67 minutes per day per OR!
- When nurses prepared their cases using paper-based preference cards, the average OR usage was 63%.
- After launching the MM module in July 2003, the average OR usage increased to 73%.
- After launching the carousel in May 2004, the average OR usage increased to 77%.
- 19 minutes more per OR per day.
- 48 minutes more per OR per day.
Case #2 - 4 improvement projects to increase capacity

• Use of disposable linens
• Sorting of instruments by personnel in the CSR
• Use of disposable surgical kits
• Optimization of the OR supply chain and material management through the implementation of a two-bin system and the delegating of case preparation to support personnel.
Simulated gains following the implementation of 4 OR supply chain improvement projects

• The chart below presents the extrapolation of the results over a full year.

<table>
<thead>
<tr>
<th>Projected benefits</th>
<th>Labor</th>
<th>Additional productivity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regular time</td>
<td>Overtime (based on time and a half)</td>
<td>OR productivity (hours)</td>
</tr>
<tr>
<td>46 hrs</td>
<td>945 hrs 22 min</td>
<td>1 079 hrs 43 min</td>
</tr>
<tr>
<td>Total</td>
<td>$32 175.83</td>
<td></td>
</tr>
</tbody>
</table>

• This gain in capacity represents 54% of an additional OR theater.
Case #3 - Implementation of a case picking and charge capture automation solution enabled by RFID and voice technology

1. Plan the case
2. Pick predictable
3. Pick unpredictable
4. In-case consumption
5. Return unused items
Simulated gains through the implementation of a case picking and charge capture automation solution enabled by RFID and voice technology

<table>
<thead>
<tr>
<th>Description</th>
<th>Details</th>
<th>Gains / 1 yr</th>
<th>Gains / 3 yrs</th>
<th>Gains / 5 yrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recurrent</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supply chain process productivity gains</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nursing personnel</td>
<td></td>
<td>-$442 880</td>
<td>-$1 328 639</td>
<td>-$2 214 399</td>
</tr>
<tr>
<td>OR and ambulatory care support personnel*</td>
<td></td>
<td>-$187 775</td>
<td>-$563 325</td>
<td>-$938 875</td>
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<tr>
<td>CSR attendants (OR)</td>
<td></td>
<td>-$275 818</td>
<td>-$827 455</td>
<td>-$1 379 092</td>
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<tr>
<td>Stores</td>
<td></td>
<td>$249 088</td>
<td>$747 265</td>
<td>$1 245 441</td>
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<tr>
<td>CSR</td>
<td></td>
<td>$89 309</td>
<td>$267 927</td>
<td>$446 545</td>
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<tr>
<td>Sub-total</td>
<td></td>
<td>-$568 076</td>
<td>-$1 704 227</td>
<td>-$2 840 379</td>
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<tr>
<td>Reduction in shrinkage: 3% of distributed value</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Stock products</td>
<td></td>
<td>-$103 193</td>
<td>-$309 578</td>
<td>-$515 964</td>
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<tr>
<td>Non-stock products</td>
<td></td>
<td>-$429 280</td>
<td>-$1 287 841</td>
<td>-$2 146 402</td>
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<tr>
<td>Consignment products</td>
<td></td>
<td>-$137 118</td>
<td>-$411 355</td>
<td>-$685 591</td>
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<td>Sub-total</td>
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<td>-$669 591</td>
<td>-$2 008 774</td>
<td>-$3 347 957</td>
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<tr>
<td>Non-recurrent sub-total</td>
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<td>-$1 237 667</td>
<td>-$3 713 002</td>
<td>-$6 188 336</td>
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<tr>
<td>Non-recurrent</td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>Optimization of inventory levels</td>
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<td></td>
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<tr>
<td>Stock products</td>
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<td>$29 662</td>
<td>$51 908</td>
<td>$57 470</td>
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<tr>
<td>Non-stock products</td>
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<td>-$1 130 479</td>
<td>-$1 978 338</td>
<td>-$2 190 303</td>
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<tr>
<td>Sub-total</td>
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<td>-$1 100 817</td>
<td>-$1 926 430</td>
<td>-$2 132 833</td>
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<tr>
<td>Non-recurrent sub-total</td>
<td></td>
<td>-$1 100 817</td>
<td>-$1 926 430</td>
<td>-$2 132 833</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>-$2 338 484</td>
<td>-$5 639 431</td>
<td>-$8 321 169</td>
</tr>
</tbody>
</table>

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