My Experiences with China: A Logistics Research Perspective

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Outline

- Introduction
- A Case Study
  - Pratt & Whitney and Chengdu Aerotech, Global Logistics System Effectiveness (2000-2001)
- A Plant Tour
  - China First Automobile Group Corp. (Summer, 2004)
- Discussions and Conclusions
1. Introduction

- My Research Interests
  - Efficient strategies, decisions & methods for supply & distribution networks
  - Global logistics and supply chain process design and management
  - Outsourcing strategies to China

- Research Collaboration with Chinese Universities
  - **Sea-Sky Scholar**, School of Management, Dalian University of Technology, June ’05 – June ‘08
    - Logistics research
    - Logistics education
  - **Guest Research Scholar**, School of Economics & Management, Southeast University, Sept. ’04 – present
    - Global procurement strategies, and dynamic pricing decisions and methods in global e-commerce environment
    - Business models and operations strategies for logistical services in China

- The project was supported by APICS – the E&R Foundation, Supply Chain Council, Pratt & Whitney, and Chengdu Aerotech

- Major Publications:
Company Background

The Parent Company - Pratt & Whitney:

• A leader in the design, manufacture and support of engines for commercial, military and general aviation aircraft, and space propulsion systems
• Truly worldwide: representatives in 97 cities in 47 nations
• Partnerships and joint ventures have reached to Asia and Europe

The Joint Venture - Chengdu Aerotech:

• established in 1996 by three partners: Company P (50.5%); a local engine company (39.5%), and Aviation Authority of China (10.5%)
• formed as a world-class manufacturer of sheet metal fabrication
• divided into four manufacturing cells
Characteristics of the Products

• Major Parts Produced at the JV

<table>
<thead>
<tr>
<th></th>
<th>Weight (kg)</th>
<th>Value ($/unit)</th>
<th>Volume (CBM)</th>
<th>Yearly demand</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pin Disk</td>
<td>35</td>
<td>5,000</td>
<td>0.061</td>
<td>1000</td>
</tr>
<tr>
<td>Burner Cans</td>
<td>24</td>
<td>1,300</td>
<td>0.172</td>
<td>1500</td>
</tr>
<tr>
<td>Shroud Assembly</td>
<td>33</td>
<td>15,000</td>
<td>0.192</td>
<td>400</td>
</tr>
<tr>
<td>Average/Total</td>
<td>29</td>
<td>7100</td>
<td>0.137</td>
<td>2900</td>
</tr>
</tbody>
</table>

• Quality of the Outsourced Parts
  - Excellent at the end of production line
  - Problems primarily come from handling and shipping
JT8D Pin Disk
Burner Can

JT8D 火焰筒
JT8D Burner Can
Stator and Shroud Assemblies
Transportation Route

Raw Materials (US to China)

Int'l Purchasing JV Team at Company P

Is the material shipped by air?

No

Yes

Air

Beijing

Chengdu

Customs

JFK

Shanghai

Customs

Long Beach

Chengdu

Water

Rail/Truck

The JV in Chengdu

Finished Products (China to US)

Is the part shipped by air?

No

Yes

Air

Beijing

Chengdu

Customs

JFK

Shanghai

Customs

Long Beach

Chengdu

Water

Rail/Truck

Company P
Evaluating the Materials Flow Process

Three Major Criteria Are Developed:

(1) Process cycle time = manufacturing + delivery
   - Manufacturing: 3 weeks for each batch order
   - Delivery: an event-based timing approach

(2) Logistics cost
   - Categorization and quantification
   - An evaluation procedure

(3) Cost-to-value ratio
   \[ \frac{\text{logistics cost per year}}{\text{value of (raw materials, added service, finished part)}} \]
### Delivery Time of the Five Transportation Modes (in days)

<table>
<thead>
<tr>
<th>Alternatives</th>
<th>US to China</th>
<th>China to US</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Time</td>
<td>Delay</td>
</tr>
<tr>
<td>Air</td>
<td>9.25</td>
<td>5</td>
</tr>
<tr>
<td>W-R FCL</td>
<td>43.5</td>
<td>16.5</td>
</tr>
<tr>
<td>W-R LCL</td>
<td>50.5</td>
<td>18.5</td>
</tr>
<tr>
<td>W-K FCL</td>
<td>38</td>
<td>14.5</td>
</tr>
<tr>
<td>W-K LCL</td>
<td>45</td>
<td>16.5</td>
</tr>
</tbody>
</table>

**Legend:**
- W-R FCL: water-rail full container load
- W-R LCL: water-rail less container load
- W-K FCL: water-truck full container load
- W-K LCL: water-truck less container load
Logistics Cost Components

**Transportation Costs** ($C_t$)
1. Freight charge ($f(Q)$)
2. Consolidation charge ($g(Q)$)
3. Transfer fee ($$/shpm$
4. Pickup & Delivery charge ($$/shpm

**Customs Charges** ($C_c$)
1. Customs clearance ($$/shpm)
2. Brokerage fee ($$/shpm)
3. Allocation fee ($$/shpm)

**Inventory Holding Costs** ($C_h$)
1. Pipeline inventory ($$/$/yr)
2. Safety stock ($$/$/yr)

**Risk Costs** ($C_r$)
1. Damage/Loss/Delay ($$/)$
2. Insurance ($$/$)

**Administration Costs** ($C_a$)
1. Order processing ($$/shpm$
2. Communication ($$/shpm$
3. Overhead ($$/shpm$

**Handling & Packaging Costs** ($C_m$)
1. Terminal handling cost ($$/shpm$
2. Material handling cost ($$/shpm$
3. In/out handling cost ($$/shpm$
4. Disposal charge ($$/shpm$
5. Packaging/supplies materials ($$/$
6. Storage cost ($$/kg/day$

**Total Logistics Cost Component**
1. Evaluate the cost effectiveness of sourcing from international suppliers

2. Available alternatives
   - All Air
   - Water-Rail Combination
     - 2. W-R FCL
     - 3. W-R LCL
   - Water-Truck Combination
     - 4. W-K FCL
     - 5. W-K LCL

3. Criteria & Inputs
   - Transportation
   - Inventory
   - Administration
   - Customs
   - Risk & Damage
   - Handling and Packaging

4. Reclassification
   - Weight-based
   - Value-based
   - Shipment Frequency based

5. Calculation
   - Construct a cost matrix
   - Obtain percentages of logistics cost
   - Perform sensitivity analysis

Logistics Cost Evaluation Procedure

Spreadsheet-based

Optimization-based
Design Issues: Two Alternatives

• **Vendor Required Material (VRM) Structure**

  P&W purchases and supplies the raw material for JV. P&W is also financially responsible for shipping the material to JV. JV then performs its machining operations on the raw material and bills P&W for the value-added service.

• **Vendor Supplied Material (VSM) Structure**

  JV procures its own raw materials and consumables and uses these items to produce a final product. The selling cost of the product incorporates all the costs to the company, including transportation costs for the raw material, and the desired mark-up for the finished goods.
**Vendor Required Material Structure (VRM)**

- **Customer Schedule**
- **Buyer Planner**
- **Materials Management**
- **Raw Material Supplier**
- **Other Parts Center**

**Outbound Logistics**
- **Int’l Purchasing Team**
- **Expeditors International**

**Global Sourcing Process**
- **Transport Mode Selection:**
  1. Air
     - JFK → Beijing → Chengdu
  2. Ocean-Rail
     - Long Beach → Shanghai
     - Customs → Rail → Chengdu
  3. Ocean-Truck
     - Long Beach → Shanghai
     - Customs → Truck → Chengdu

**Manufacturer (the JV)**
- **Receive Material**
- **Production Schedules**
- **Pull Inventory**
- **Build Product**
- **Quality Control**
- **Plan Delivery**

**Inbound Logistic**
- **US Customs**

**Mode Selection:**
1. Air
2. Ocean-Rail
3. Ocean-Truck

**Freight Forwarder**
VSM

Vendor Supplied Material Structure
# Advantages and Challenges

<table>
<thead>
<tr>
<th>VRM Structure</th>
<th>Advantages</th>
<th>Challenges</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Company P</td>
<td>JV</td>
</tr>
<tr>
<td></td>
<td>• Has full control</td>
<td>• Less financial responsibility</td>
</tr>
<tr>
<td></td>
<td>• Easy to make changes</td>
<td>• Focus on production planning &amp; scheduling</td>
</tr>
<tr>
<td></td>
<td>• Highest degree of independence</td>
<td></td>
</tr>
<tr>
<td>VSM Structure</td>
<td>• Focus on coordination</td>
<td>• Smoother production and resource planning</td>
</tr>
<tr>
<td></td>
<td>• Focus on strategic planning</td>
<td>• More flexibility &amp; communication with suppliers</td>
</tr>
<tr>
<td></td>
<td>• Less involvement in production &amp; distribution</td>
<td></td>
</tr>
</tbody>
</table>
## Assessment of Integration

<table>
<thead>
<tr>
<th>Dimensions of Supply Chain Integration</th>
<th>VRM Structure</th>
<th>VSM Structure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information Integration</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Information Sharing</td>
<td>Poor</td>
<td>Good</td>
</tr>
<tr>
<td>2. Collaborative Planning</td>
<td>Poor</td>
<td>Good</td>
</tr>
<tr>
<td>3. Forecasting</td>
<td>Good</td>
<td>Fair</td>
</tr>
<tr>
<td>4. Replenishment</td>
<td>Poor</td>
<td>Good</td>
</tr>
<tr>
<td>Coordination</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Decision Delegation</td>
<td>Poor</td>
<td>Good</td>
</tr>
<tr>
<td>6. Work Alignment</td>
<td>Poor</td>
<td>Good</td>
</tr>
<tr>
<td>7. Resource Allocation</td>
<td>Fair</td>
<td>Good</td>
</tr>
<tr>
<td>Organizational Linkage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Channels of Communication</td>
<td>Poor</td>
<td>Good</td>
</tr>
<tr>
<td>9. Distribution of Accountability</td>
<td>Poor</td>
<td>Fair</td>
</tr>
<tr>
<td>10. Monitor of Performance</td>
<td>Good</td>
<td>Fair</td>
</tr>
</tbody>
</table>

# Classification of Management Issues

<table>
<thead>
<tr>
<th>Mgt Level</th>
<th>Flow</th>
<th>Material</th>
<th>Information</th>
<th>Cash</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strategic</td>
<td>(1) Who controls the movement of the goods?</td>
<td>(1) Is the Information Technology (IT) Department at the global supplier sufficiently staffed?</td>
<td>(1) Who is responsible for paying the raw materials and transportation?</td>
<td></td>
</tr>
<tr>
<td>Tactical</td>
<td>(1) What are the MRP schedules? (2) What are the procedures at the customs? (3) What is the best transportation mode? (4) Who should be responsible for transportation?</td>
<td>(1) How is information transferred between the trading partners? (2) What is the IT infrastructure at the global supplier? (3) What is the suitable format for storing information?</td>
<td>(1) What is the payment cycle? Should it be the same as the delivery cycle?</td>
<td></td>
</tr>
<tr>
<td>Operational</td>
<td>(1) What are the packaging and material handling procedures and policies? (2) How are inventories controlled? (3) How to determine the purchasing cycle?</td>
<td>(1) Are the IT components adequate to ensure timely information transfer? (2) Is the IT personnel sufficiently trained?</td>
<td>(1) How to analyze the impact of exchange rate? (2) What is the form of fund transfer?</td>
<td></td>
</tr>
</tbody>
</table>
Outsourcing Process

1. Investigation and Tendering
   - Analysis of company, customer & competitor
   - Sourcing strategy

2. Evaluation
   - Selection criteria
   - Pre-screening
   - Estimate economic & operating benefits

3. Supplier Selection & Development
   - Negotiation
   - Technical assessment
   - Savings identification
   - Implementation schedule

4. Implementation
   - Team, strategy & schedule
   - Agreement on supply & Logistic terms
   - Measurement of actual performance
   - Progress report

5. Performance Measurement & Continuous Improvement
   - Monitor supplier’s performance
   - Continuous improvement opportunities
   - Relationship analysis
   - Maintain dynamic & flexible procurement process

Core activities:
- Analysis of company, customer & competitor
- Sourcing strategy

Selection criteria:
- Selection criteria
- Pre-screening
- Estimate economic & operating benefits

Technical assessment:
- Negotiation
- Technical assessment
- Savings identification
- Implementation schedule

Team, strategy & schedule:
- Team, strategy & schedule
- Agreement on supply & Logistic terms
- Measurement of actual performance
- Progress report

Performance Measurement & Continuous Improvement:
- Monitor supplier’s performance
- Continuous improvement opportunities
- Relationship analysis
- Maintain dynamic & flexible procurement process
### Future Research

<table>
<thead>
<tr>
<th>1</th>
<th>……</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Investigation &amp; Tendering</strong></td>
<td><strong>Implementation</strong></td>
<td><strong>Performance Measurement &amp; Continuous Improvement</strong></td>
<td></td>
</tr>
</tbody>
</table>

- **Core activities**
  - Analysis of company, customer & competitor
  - Sourcing strategy
- **Investigation & Tendering**
  - Core activities:
    - Investigation & Tendering
    - Core activities: Analysis of company, customer & competitor
    - Sourcing strategy
- **Team, strategy & schedule**
- **Agreement on supply & Logistic terms**
- **Measurement of actual performance**
- **Progress report**
- **Chain Structure Design**
- **Manufacturing & Logistics**
- **Monitor supplier’s performance**
- **Continuous improvement opportunities**
- **Assessment of integration**
- **Maintain dynamic & flexible procurement process**
- **Info integration**
- **Coordination**
- **Org linkage**

**Flow/Level Matrix**

```
M | I | F
S | T | O
```
3. A Plant Tour (Summer 2004)

- China’s First Automobile Group Corp. (originally First Automobile Works, FAW)
  - An Overview
  - FAW Import & Export Corp.
  - FAW-Volkswagen
  - Logistics Development
An Overview of FAW (1 of 3)

- Broke ground on July 15, 1953 and started China’s automobile industry
- Headquartered in China’s northeastern hinterland in the city of Changchun, Jilin Province
An Overview of FAW (2 of 3)

- Three important milestones:
  - Trucks only → light-duty trucks and cars
  - In 1991, established joint venture with Volkswagen
  - In 2002, began cooperation with Toyota Motor Corp.

- FAW now has 30 wholly owned subsidiaries and 15 subsidiary companies

- FAW factories and research institutes are located in 19 regions in 31 provinces, cities, and autonomous regions, which are mainly in northeastern and southwestern China

- In 2003, the company’s total assets were valued at ¥106.2 billion, and the firm employed 124,000 employees
### Key Financial Data of FAW (3 of 3)

<table>
<thead>
<tr>
<th>Year</th>
<th>Sales of Vehicle (unit)</th>
<th>Sales Income (100 million yuan)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td>902,329</td>
<td>1,140</td>
</tr>
<tr>
<td>2002</td>
<td>580,356</td>
<td>845.10</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Categorized Product Sales</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Cars</td>
<td>568,463</td>
<td>248,090</td>
</tr>
<tr>
<td>Heavy-duty Trucks</td>
<td>95,336</td>
<td>118,985</td>
</tr>
<tr>
<td>Mid-sized Trucks</td>
<td>66,742</td>
<td>81,734</td>
</tr>
<tr>
<td>Large-Medium-duty buses</td>
<td>1,429</td>
<td>1,718</td>
</tr>
<tr>
<td>Light-duty Trucks</td>
<td>59,883</td>
<td>41,776</td>
</tr>
<tr>
<td>Vans</td>
<td>12,465</td>
<td>17,742</td>
</tr>
<tr>
<td>Mini Buses</td>
<td>91,880</td>
<td>70,321</td>
</tr>
<tr>
<td>Mini Trucks</td>
<td>6,131</td>
<td>-</td>
</tr>
</tbody>
</table>

### Source
FAW 2003 Annual Report
FAW Import & Export Corp. (FAWIEC)

- Established in 1984 as FAW’s wholly-owned subsidiary
- **Key Businesses**
  - International marketing: export of CBUs
  - International marketing: export of components & parts
  - International purchasing
  - International cooperation
  - International bidding
  - Development of logistics services
## FAWIEC’s Financial Summary

<table>
<thead>
<tr>
<th></th>
<th>2003</th>
<th>2002</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total I/E Volume</td>
<td>$1,545.4 million</td>
<td>$338.9 million</td>
</tr>
<tr>
<td>Import Volume</td>
<td>1,486.8</td>
<td>270.0</td>
</tr>
<tr>
<td>Export Volume</td>
<td>58.6</td>
<td>68.9</td>
</tr>
<tr>
<td>Sales Income</td>
<td>1,512.9</td>
<td>335.5</td>
</tr>
<tr>
<td>Profits</td>
<td>14.1</td>
<td>3.9</td>
</tr>
</tbody>
</table>

Source: 2003 FAWIE Annual Report
FAW-Volkswagen Automobile Co., Ltd

- A large-scale joint venture passenger car manufacturer
- Established in 1991, with the first Jetta automobile rolling off the assembly line on December 5 of that year. Audi AG became a member of the partnership in 1995, and full scale production commenced in July of 1996.
- The company covers an area of 1.16 million square meters with a total investment of 11.13 billion Yuan and registered capital of 3.71 billion Yuan.
- Following 10 years of continuous construction and development, the product offerings of FAW-Volkswagen have extended from the Jetta sedan to include the Bora (Jetta in U.S.), Golf, Audi A4, and A6. Production capability has reached an annual output level of 330,000 vehicles, 300,000 engines, and 180,000 transmissions.
On July 1, 2003, the board of directors of FAW-VW Automobile Co., Ltd. approved the construction of FAW-Volkswagen’s Plant II, while simultaneously increasing the total investment from 11.13 billion Yuan to 23.435 billion Yuan (US $2.8 billion) with a registered capital increase from 3.71 billion Yuan to 7.812 billion Yuan (US $945 million). At present, 350,000 square meters of Plant II’s 660,000 square meter design has been completed.

Plant II will consist of 4 production areas, including stamping, welding and sub-assembly, painting and sub-assembly, and final assembly. Production will be focused on new PQ35 platform which includes the Bora V, Golf V, and recently announced Caddy MPV. The first Changchun-produced Caddy prototype was completed on July 1st of 2004, with pre-production commencing October 12, 2004.
一次就把事情做对
Logistics Development

- Changchun Supply Automobile Logistics Development Co., Ltd (CSALD)
  - Officially established in July 2003 as a JV
  - Adopted advanced global management techniques to provide SCM services and solutions for FAW and China’s auto industry as a whole
  - To support FAW-VW Plant 2 operations

- Changchun FAW International Logistics Center
  - Wholly owned by FAWIEC
  - I/E cargos DC for FAW
Basic Statistics of FAW-ILC

- The center employs 172 people, including 24 managers
- The center occupies 220,000m², of which 10,000m² is the warehouse space
- The warehouse capacity is 100,000 TEUs per year
- The center owns 640m-long railway especially for containers shipment
- Followed ISO 9000 certification standards to establish and perfect quality management systems
FAW-ILC Services

- Integration of I/E materials and information flows
- Information center of I/E logistics services
- Logistics service provider (3PL)
- Supporting FAW’s I/E businesses
- Developing logistics strategies and relationships
- Specific responsibilities
  - Cost reduction
  - Risk sharing
  - Supply chain management
  - Inventory reduction
  - Main resource consolidation and centralization
  - Customer service satisfaction improvement
  - Professional operations
Areas of Concerns/Interests

- **3PLs: the Present and Future**
  - The development trend of American’s 3PLs and 4PLs, and obstacles experienced in the development process
  - The role of 3PLs in supply chain design and commonly seen mistakes
  - The operating models of 3PLs and the key sources of profit
  - The differences between China’s and America’s 3PLs
  - The required skill sets of professional 3PL managers, and the training curriculum
  - A case study of the entire operational process at an American 3PL’s distribution center for automotive industries
Areas of Concerns/Interests

- **Applications of Technologies in Logistics**
  - The commonly used technologies including IT in warehousing management and operating procedures in America’s automotive supply chains
  - The current application of virtual reality to identifying logistical solution alternatives

- **Regulations and Policies**
  - What are the regulations available for warehousing related operations, including fire protection, personnel management, and environmental protection?
  - What are the standards and policies for Distribution Centers?
Discussions

3PL’s International Networks: Key Focus

- China coastal area infrastructure / operations: 11%
- China inland infrastructure / operations: 10%
- National Chinese infrastructure / operations: 6%
- Intra-Asian routes: 10%
- Outbound Asia-US routes: 16%
- Outbound Asia-EU routes: 12%
- Inbound US-Asia routes: 11%
- Inbound EU-Asia routes: 8%
- Overall international networks: 17%

Challenges

- Present Key Challenges for the Logistics Industry
  - Government regulation: 48%
  - Quality of service: 43%
  - Transportation & logistics data tracking: 41%
  - Cargo security: 38%
  - Local knowledge / expertise: 36%
  - Ocean / Port capacity: 34%
  - Internal road and rail networks: 33%
  - Web-based operations / capabilities: 25%
  - Air capacity: 21%

Future

● Key Challenges in the Next 5 Years
  – Government regulation: 47%
  – Quality of service: 37%
  – Internal road and rail networks: 37%
  – Transportation & logistics data tracking: 32%
  – Local knowledge / expertise: 27%

● Implications
  – Potential of China’s operation is significant and the challenges are vast
  – Right decision and right knowledge are critical

My Research Interests

- Operational Process of International 3PLs’ Business in China
- Operating models and strategies appropriate for Chinese environment
- Service integration and knowledge transfer