



Integrated Supply Chain Engineering

IBM Integrated Supply Chain *Engineering Services*

BJ Steele 11/18/2009

Today's Agenda

- **IBM Direct Procurement Engineering Services**
 - Introduction and Value Proposition
 - Engineering Services Overview
 - Client References
 - Contacts
 - Discussion

Our industry leading global supply chain vast resources and infrastructure crosses multiple products, services, and geographies.

Accomplishments:

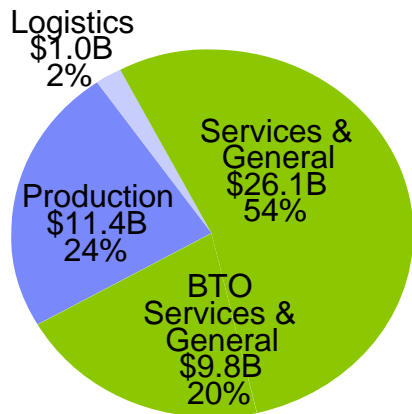
- **> \$6 B cost reduction**, for several years in a row
- **> 98% defect-free installations**
- **Rated #4** in AMR Research's 2009 Supply Chain Top 25

Scale:

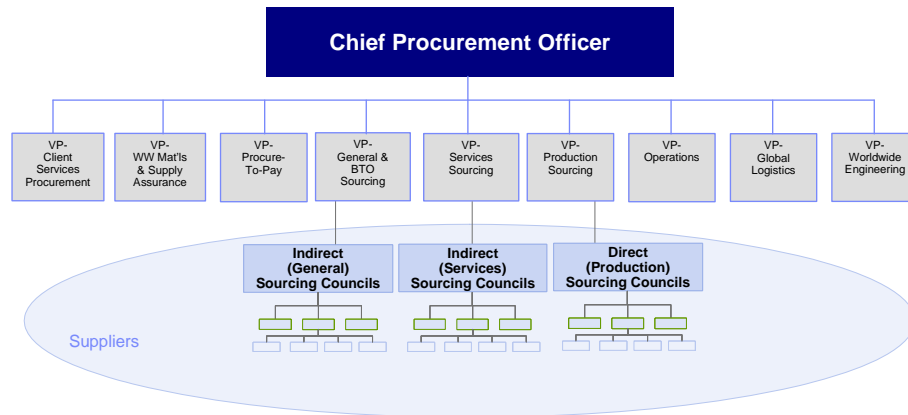
- **50 years** experience in server hardware manufacturing
- **17,000 employees**
- **100 locations**
- **56 countries**
- **\$48B of procurement**
- **78,000 products**, with 3 million configurations
 - from paperclips to supercomputers
- **35,000 suppliers** connected to IBM via the Web
- **45,000 Business Partners** worldwide

Our supply chain manages a large global spend consists of leading practices and sourcing strategy.

With revenue of \$103 B in 2008, IBM has the largest managed global spend (\$48.3B) base of any outsourcing provider and demonstrated scale in operations



Global sourcing councils form the core of IBM's organization structure for procurement



World Wide Procurement Locations



Production Councils provide depth and breadth of expertise

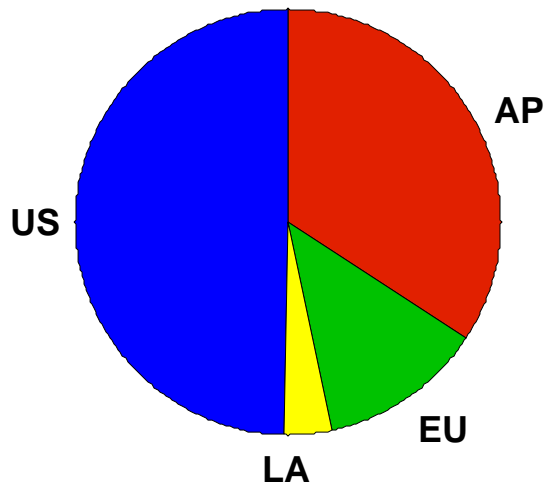
- Electronic Manufacturing Services
- Electronic Components
- Memory
- Platform (including mechanicals, power, cables, connectors)
- Communications
- Printed Circuit Boards
- Storage commodities and system peripherals
- Logistics
- Technical Support Services
- Semiconductor Chemicals and Gases
- Semiconductor Technology
- Semiconductor Raw Wafers
- Manufacturing Equipment

ISC Engineering

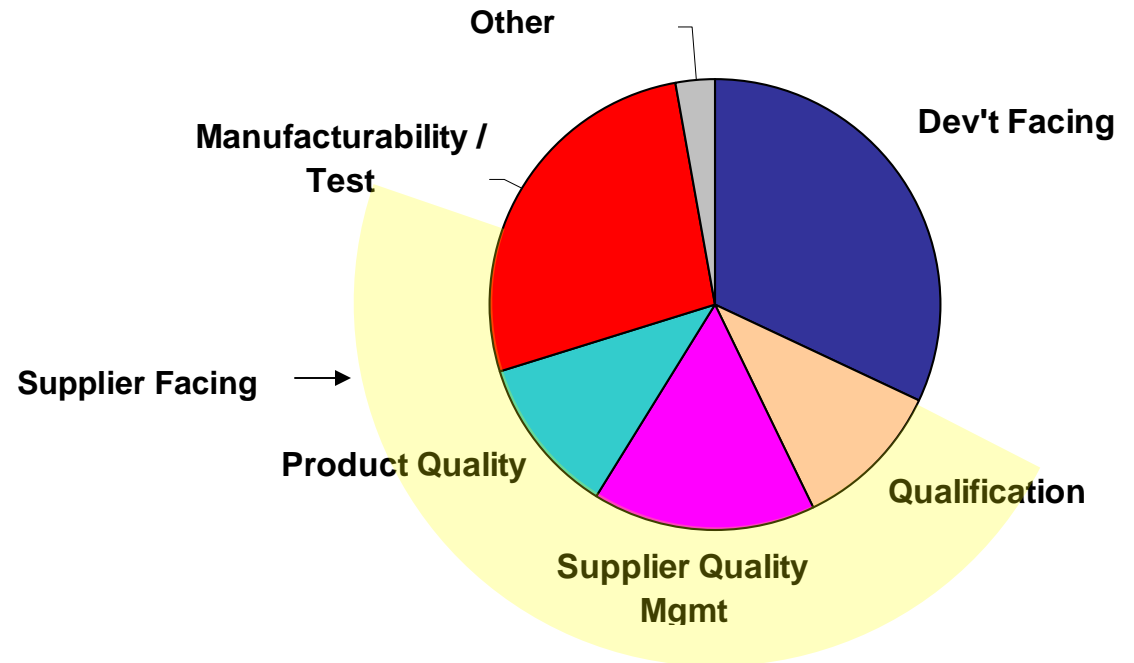
- **Employees:** ~1700 Worldwide, including 4 Distinguished Engineers, 3 Master Inventors, and 18 Senior Technical Staff Members
- **Locations:** US, Canada, China, France, Germany, Hong Kong, Hungary, Ireland, Italy, India, Japan, Korea, Malaysia, Mexico, Scotland, Singapore, and Taiwan
- **Technical Influence:** Spans all of IBM's products, including all server brands (xSeries, Power Systems, and Mainframes), Retail Store Solutions (RSS), and Storage Systems
- **The mission of the Integrated WW ISC Engineering team is to:**
 - Maximize the efficiency of the global team by implementing best practices across brands, platforms, divisions, and geographies
 - Apply technical expertise across the end-to-end supply chain to improve the entire product life cycle, from technology selection through manufacturing through field support
 - Innovate to deliver leading-edge and high-quality technical solutions to ensure customer satisfaction and improve warranty savings / cost avoidance
 - Deliver world class solutions on services engagements with clients

ISC Engineering Employees by Geography

WW Employees by Geography



WW Population in Job Categories



IBM Direct Procurement Services

- In response to growing client interest, IBM's Global Business Services and Integrated Supply Chain partnered to deliver direct procurement services
- Over the last five years we have delivered client engagements in diverse industries... Telecom, Networking, Storage, Electronics, Semiconductor, Automotive, and Medical industries
 - in the US, Europe, and Asia Pacific geographies
- **How we differ** from other Supply Chain consultants:

We **are** a world-class Supply Chain Organization.



deep and broad technical and commercial expertise that is both **current** and **hands-on**.

IBM's Value Proposition – Procurement Services

- **Leverage IBM's world-class Procurement capabilities ...**
 - deep and broad technical expertise
 - hands-on business skills
 - global footprint
 - proven tools and processes
 - demonstrated results, within IBM and for external clients

 - **... to drive real results in your business**
 - reduce end-to-end cost
 - improve continuity of supply
 - improve the quality of your products
 - proactively ensure component quality and availability
 - solve quality and availability problems quickly and effectively
 - improve new product introductions
 - improve environmental compliance

Suppliers can be clients

- Pace of innovation outstrips an organization's ability to "go it alone"
- IBM can help you become more competitive through new technology enablement, improved quality and reliability, and reduced costs

➤ Enable suppliers / clients to be more **competitive**



Globally Integrated Direct Procurement Services End To End Direct Procurement Services Capability

Product Life Cycle Management

- supplier early involvement
- new products introduction
- Design for Cost / Design for Supply Chain

Spend Analysis

- spend per commodity
- spend per country
- spend per business unit

Procurement Engineering

- component engineering
- end-to-end quality management
- quality processes and systems
- manufacturing engineering
- sustainability and compliance (RoHS, Reach..)

Cost Engineering

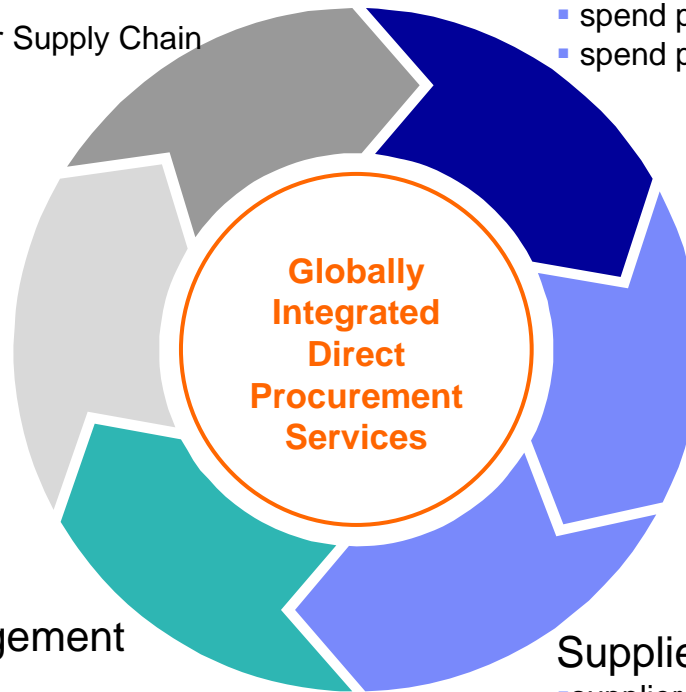
- cost breakdown
- business case support
- fact-based negotiations

Supplier Management

- early involvement
- continuous cost takedowns
- audits

Supplier Selection and Sourcing

- supplier identification / evaluation
- individual supplier selection per commodity (electronics / platform / CapEx / packaging / logistics)



Engagement options



IBM's Integrated Supply Chain Assets

Areas of Expertise

- PCB technologies, construction, materials, testing, consultation
- Electronic assembly
- Bond / Assembly / Test
- Commercial Procurement: sourcing, purchasing strategies, negotiation methodologies, contract writing, contract execution, relationship management
- Cost engineering
- Dfx (x = Test, Reliability, Cost)
- Electronic commodities function, quality, & reliability
- Environmental compliance technology and legislation
- Final product packaging/shipping
- Market Intelligence: industry/technology roadmaps, supplier capabilities, pricing, market analysis
- Mechanical assemblies
- Mfg. change management (configurations, ECs)
- Mfg. quality systems
- Pb-free assembly
- Power
- Reliability modelling
- Statistical Process Control
- Supplier Quality Management
- Test engineering
- Thermal engineering

Capabilities

- BoM optimization
- Classical testing (shock/vibration)
- Compliance testing (environmental; UL / EMI / FCC)
- Design Reviews (function, cost, manufacturability, yield, reliability)
- End-of-Life management
- Engineering Change management
- Failure analysis & constructional analysis
- PCB Flatness & LGA Au Qual
- Improve mfg. operations
- Manage mfg. exceptions and excursions
- Manage warranty processes (RMAs, F/A, FMEAs)
- New Product Introduction (release to mfg. and volume ramp-up)
- Rapid-response alternate sourcing for continuity of supply
- Supplier Audits and Qualifications
- Supplier Relationship Management (business and technical)
- Supply-chain reviews (supplier readiness, manufacturing readiness)
- Technical Project Management
- Technology Qualifications
- Test development & test engineering
- Training / education (business and technical)

Databases and Tools

- ANSYS finite-element modelling tool for thermal/mechanical analysis
- Cadence Allegro for RF/mixed-signal design
- Commodity market price dB
- Costimator cost engineering tools
- Environmental compliance dB (EMARS / CRS)
- HPSS high-frequency analog modelling tool
- Materials and Process Engineering lab (RTP, Poughkeepsie, Rochester) (mass spec., FTIR, SEM, EDACs, XRF, Thermal/mechanical, Differential Scanning Calorimetry)
- Memory test lab
- Part number technical dB (quality, reliability, approved applications)
- xPlore component dB & associated tools (supplier problem log, PCNs, TQA, QIN, environmental data, SQUIT, Early Warning System)

Global Resources

- Local business relationships
- Local Commercial Procurement staff
- Local Procurement Engineering staff
- Local technical auditing staff
- Local native-language speakers
- Global communications systems

PCB Related Technology Capabilities

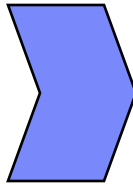
Views

PCB Strategies & Roadmaps

DFX (reliability, cost, complexity)
analysis, recommendations and
consultations

Technology Bring-Up &
Qualification

Audits & Consultation



Capabilities

- Materials (laminates, PPs, Cu, etc.) testing, analysis, recommendations and consultations
- Design Ground Rules (inc. IBM anti-smoke guidelines, outline/profile/mechanicals)
- Layer Counts, Aspect Ratios & Via Densities
- HDI & mixed fabrication modes
- Electrical performance demands
- Pb-Free & MSA requirements
- Test Vehicle designs (Gerber)
- Test & Qualification planning, analysis, recommendations (inc. specialize tests, NLC, etc.)
- FA/FMEA
- Yields & costs
- RoHS/REACH & other environmental & safety compliance requirements (*inc. MSA & Pb-Free PCB & Assembly Library available for sale*)
- Next level interconnects
- Optoelectronic Integration

PCB Assembly Related Technology Capabilities

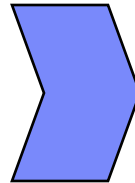
Views

PCBA Strategies & Roadmaps

DFX (reliability, cost, complexity) analysis, recommendations and consultations

Technology Bring-Up & Qualification

Audits & Consultation



Capabilities

- Materials testing, analysis, recommendations and consultations (*expanded to include solders & fluxes*)
- Design Ground Rules (inc. IBM anti-smoke guidelines, outline/profile/mechanicals)
- Layer Counts, Aspect Ratios & Via Densities
- HDI & mixed fabrication modes
- Electrical performance demands
- Pb-Free & MSA requirements
- Test Vehicle designs (Gerber)
- Test & Qualification planning, analysis, recommendations (inc. specialize tests, NLC, etc.)
- FA/FMEA
- Yields & costs
- RoHS/REACH & other environmental & safety compliance requirements (*inc. MSA & Pb-Free PCB & Assembly Library available for sale*)
- Next level interconnects
- Optoelectronic Integration
- **Component selection, BoM Scrubs**
- **Thermal Profiles**
- **Component Rework**
- **ICT & FCT**
- **Assembly Yield Management**

Lean Six Sigma Educational Opportunity (LEO) Training Benefits for Suppliers

- **Training** - 4 days of in-class training @ Green Belt level, industry recognized best-practice
- **New Skills** - proven methods & tools that will help suppliers improve their process/service/products
- **Project Coaching Support** - IBM Black Belts to help you through the training and project stages
- **Improved Product/Process Performance**
 - 14 supplier reps have already participated in the ISC Eng LSS GB Training Pilot
 - 9 AP, 4 EMEA, 1 US
 - 12+ projects projecting > \$7 mil in cumulative benefits
- **Potential for Increased Customer Satisfaction**
- **Lean Six Sigma Green Belt Certification!**
- **1st Seat Free (contact E. Kline)**

Client Engagement Examples

- **Quality Improvement**
 - **Telecom** client: Created a comprehensive Quality Management System; made recommendations for creating an effective world-wide supplier quality management system, including the skills and resources required
 - **Semiconductor** and **PCB** clients: Resolved quality issues, and provided consulting services for failure analysis and corrective actions
- **Technology Qualification and Development**
 - **PCB** client: Enabled supplier to introduce advanced technology by providing consultation services and knowledge transfer.
- **Manufacturing**
 - **Telecom** client: Resolved throughput issues in a card assembly line, and provided consulting services to avoid future throughput issues
- **Cost Engineering and Best-Cost Geography Sourcing**
 - **Electronics** clients (Japan and Europe): Reduced costs by transitioning products and sourcing to China, saving several million dollars
 - **Automotive** client (Europe): Reduced costs by transitioning products to China; found and qualified new suppliers of components and manufacturing services, and managed new suppliers' quality
- **Sustainable Procurement**
 - **Storage** client: Provided lead-free qualification services, and provided consulting services for RoHS compliance
 - **Medical Equipment** client: Provided consulting services for lead-free and RoHS compliance
- **Training Workshops**
 - **Network** client: Taught training workshops in Semiconductor Fabs and Semiconductor Packaging/Assembly
 - **Electronic Components** : Taught supplier quality management and Audit workshops



Discussion

IBM Contacts



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Thank you.

deeper insight
deeper accountability
deeper expertise
deeper technology
deeper resources
deeper experience
deeper answers
deeper capabilities
deeper research
deeper knowledge
deeper solutions
deeper integration
deeper value
deeper e-business
deeper thinking
deeper transformation
deeper innovation
deeper results



Integrated Supply Chain Engineering

Client References (selected)

IBM Direct Procurement Services

Project Reference: PCB Supplier Technology Development & Qualification

Company	<i>Undisclosed PCB Client</i>	Project	Bring Supplier Up PCB Technology Curve
Challenge	Industry	PCB	
<ul style="list-style-type: none"> ▪ Negotiate up the PCB technology curve in aggressive time-frame ▪ New materials ▪ More demanding ground rules ▪ More complex designs ▪ Higher layer counts, higher aspect ratios ▪ Rigorous quality & reliability requirements 	Goal	<ul style="list-style-type: none"> ▪ Develop a stable advanced PCB technology capability, review, analyze and recommendations concerning <ul style="list-style-type: none"> –test vehicle builds –pre-production builds –production builds –qualification results 	
Consulting approach	Results	<ul style="list-style-type: none"> ▪ Client successfully negotiating the technology curve ▪ Anticipate successful qualifications 	
<ul style="list-style-type: none"> ▪ IBM provides on-going project management and technical consultation/guidance ▪ Review & analysis of client's fabrication capabilities leading to specific recommendations ▪ Consulting on test vehicle build ▪ Consulting on pre-production ▪ Consulting on qualification vehicle build ▪ Consulting on qualification test results 			

Project Reference: PCB Supplier Technology Development & Qualification

Company	<u>Undisclosed PCB User Client</u>	Project	MSA PCB Qualification
		Industry	PCB
Challenge		Goal	
<ul style="list-style-type: none"> ▪ 245C x 4 reflow requirement ▪ DICI cured material exhibiting slight surface blisters ▪ Inter layer delaminating & IP Sep observed 		<ul style="list-style-type: none"> ▪ Determine Field Reliability Exposure <ul style="list-style-type: none"> –ATC testing of suspect population (control & experimental) confirmed high reliability risk & efficacy of short term fix ▪ Containment Actions <ul style="list-style-type: none"> –Controlled regime of containment actions permitted limited production ▪ Clearing Actions <ul style="list-style-type: none"> –Final clearing actions resolved issues permanently 	
Consulting approach		Results	
<ul style="list-style-type: none"> ▪ Tight production schedule ▪ Risk analysis and mitigation planning ▪ Containment actions ▪ Permanent corrective actions 		<ul style="list-style-type: none"> ▪ Zero field issues (> 4 years) ▪ Successful qualification ▪ Successful production ▪ Achieved GA schedule 	

Project Reference: PCB Supplier Technology Development & Qualification

Company	<u>Undisclosed PCB User Client</u>	Project	PB-Free PCB Qualification
		Industry	PCB
Challenge		Goal	
<ul style="list-style-type: none"> ▪ 260C x 4 reflow requirement ▪ Low cost material selected by customer ▪ ATC testing of 260C simulated PCBs confirmed very significant problems 		<ul style="list-style-type: none"> ▪ Determine Field Reliability Risk <ul style="list-style-type: none"> –ATC testing of suspect population (control & experimental) confirmed high reliability risk & efficacy of new mat's fix ▪ Clearing Actions <ul style="list-style-type: none"> –Immediately changed to alternate material 	
Consulting approach		Results	
<ul style="list-style-type: none"> ▪ Tight production schedule ▪ Risk analysis and solution planning ▪ Permanent corrective actions 		<ul style="list-style-type: none"> ▪ So far, no material related failures in extended reliability testing (no units fielded yet) 	