"Research to Reality" Results in Advanced Logistics Tools

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President & CEO
Global Concepts, Inc.

Prepared for: The City of Houston

7/22/04

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Business

GLOBAL CONCEPTS INCORPORATED
Design • Execute • Measure
Providers of Leading Edge Logistics Solutions

We provide high end logistics consulting services and advanced logistics software products that drastically reduce a company's supply chain expenses at a cost and timeline less than the competition.

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Global Concepts…

- **Supply chain logistics experts**
- **Over 300 years combined experience in domestic and international logistics**
- **Over ten years experience working with RFID and RFID applications**
- **Customer base includes AutoZone, Federal Aviation Administration, DoD, Trane, Celestica, Lucent Technologies, Gov. of Singapore…**

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GLOBAL CONCEPTS HISTORY

- Global Concepts founded on a rich history of Industry & Academic Collaboration
  - AT&T founding member of Material Handling Research Center, now known as TLI - 1982
  - AT&T Foundation Grant to U of A resulted in Electronics Manufacturing Textbook - 1990 to 1995
  - Global Concepts joined as the first junior member of TLI - 1996 to 2002
  - Global Concepts assisted in founding the NSF's Center for Engineering Logistics & Distribution - 2002 to Present

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Background

- Founded in 1996
- Started as a logistics consulting company
- Transitioned into a logistics consulting/products company in 2003
- Successfully integrates academics and practitioners in high performance project teams
- Proven results with a multitude of clients

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BENEFITS OF JOINT R&D

- Piecing together the gaps between available technology and practical applications
- Allows practitioners the time required to work on strategic issues
- Networking opportunities with other logistics professionals

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BENEFITS OF JOINT R&D
(con't)

- **Research scholars & interns lead to better employees**
- **Access to Technology Incubation Programs**
- **Applied research projects yield immediate results**
  - **Technology transfer**
  - **Process changes**
  - **Engineering tools**

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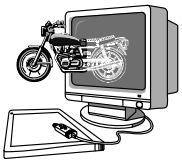
BENEFITS OF JOINT R&D
(con't)

University core competencies compliment practitioners knowledge base

- **Modeling**
  - **Optimization**
  - **Simulation**
  - **Probability & Statistics**
- **Information Technology**
  - **Technology assessment**
  - **Intelligent tracking technologies**
  - **Geographic information systems**
  - **Decision Support systems**



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BENEFITS OF JOINT R&D
(con't)

- **Ability to leverage research funding from Industry, University, & Government sources**

- AutoZone
- Trane
- Texas Instruments
- Tyson's
- Lucent
- Wal-Mart
- Raytheon
- Bell Labs
- University of Arkansas
- Georgia Institute of Technology
- University of Oklahoma
- Nanyang University
- University of Louisville
- Oklahoma State University
- NSF
- Gintec

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JOINT R&D RESULTS

- AutoZone/AT&T / Lucent/ TI/ Raytheon/ Hytrol
  - Electronics manufacturing textbook
  - State-of-the-art "material logistics mgm't system" for distribution and manufacturing (MLMS)
  - Implemented PULL replenishment at numerous manufacturing, repair and depot locations
- Avenue to educate logistics professionals by involvement in research & continuing education

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JOINT R&D RESULTS

- Academic tenure achieved through R&D funding and publications
- On-going academic revenue through royalty agreements
- Great projects for graduate students
  - Over 6 PhDs & 24 Masters degrees
- Job creation for graduates with Industry experience
- Spawns new knowledge based businesses

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PRODUCTS FOUNDED IN ACADEMIC RESEARCH

- GLOBAL's Logistic Engine
  - MHRC Research - Frazelle's Warehouse Benchmarking Study of Best Practices
  - MHRC Research - Sadiq's DSLAA Forward Picking Method
  - TLI-AR98-2: Best practices
  - TLI-AR97-7: Intelligent Tracking Technologies for Cycle Time Improvement
  - TLI-AR98-6: Monitoring Logistics Assets
  - TLI-AR96-5 Virtual Warehousing: Prototype Design and Evaluation
  - TLI-AR96-6 A Framework for Logistics Systems Metrics
  - TLI-AR96-7 Hazardous Materials Storage Criteria Review
- GLOBAL's Flow Planer
  - TLI-AR 99-4 Dynamic Scheduling for Competing Multi-stage Demands
  - TLI-AR 99-5/6 Dynamic Scheduling in a Focused Storage Environment
  - TLI-AR97-1: Focused Stores Design Methodology
  - TLI-AR97-2: Optimal Bin Sizing for Focused Storage Systems
  - TLI-AR96-3 Capacity and Capability Analysis in Repair/Rework Operations
  - TLI-AR96-4 Stock Keeping in Focused Component Stores

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PRODUCTS FOUNDED IN ACADEMIC RESEARCH (con't)

- GLOBAL's Advanced Metrics Module
  - **TLI-AR 99-8 Design of an Information Technology Architecture to Enhance Systems Level Logistics Management**
  - **TLI-AR98-1: Logistics Metrics and benchmarking**
  - **TLI-AR97-6: Design of Group Metrics for the Evaluation of Logistics Performance**
  - **TLI-AR97-3 and TLI-AR98-3: A Simulation-Based Decision Support System for Production Scheduling and Capacity Analysis in Repair/Rework Operations**
  - **TLI-AR98-5: Improved Resource Scheduling of Manufacturing Operations**
- GLOBAL's Yard Management Module
  - **MBTC-98-3: A GIS Based Intelligent Trailer Management System**
  - **MBTC-98-2: Optimal Door Assignment in Break-bulk Terminals**
  - **TLI-AR96-1 -- Warehousing Management and Hazardous Material Tracking: Installation, Integration, and Optimization**
  - **TLI-AR96-2 -- Modular Simulation Software for Flexible Material Handling Systems**

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NSF's REARCH - BEST WAREHOUSE PRACTICES WORLD-WIDE

PROCESS	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5
Receiving	Unload, Stage, & In-Check	Immediate Putaway to Reserve	Immediate Putaway to Primary	Cross - Docking	Pre - Receiving
Putaway	First-Come-First Serve	Batched by zone	Batched & Sequenced	Location - to - Stocktor	Automated Putaway
Reserve Storage	Floor Storage	Conventional Racking & Bins	Some Double Deep Storage	Some Narrow Aisle Storage	Optimal Hybrid Storage
Picking	Pick-to-Single-Order	Batch Picking	Zone Picking - Progressive Assembly	Zone Picking - Downstream Sorting	Dynamic Picking
Slotting	Random	Popularity Based	Popularity & Cube Based	Popularity, Cube, and Correlation Based	Dynamic Slotting
Replenishment	As Needed - Pick Face Complete	As Needed - Downstream Complete	Anticipated - By Sight	Anticipated - Automated	Pick from Reserve Storage
Shipping	Check, Stage, & Load	Stage & Load	Direct Load	Automated Loading	Pick - to - Trailer
Work Measurement	No Standards	Standards Used for Planning	Standards Used for Evaluation	Standards Used for Incentive Pay	Standards used for Continuous Feedback
Communications	Paper	Bar Code Scanning	RF Terminals	Handsfree	[illegible]

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PULL REPLENISHMENT TOOL IN SUPPORT OF POINT-OF-USE DESIGN

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CASE STUDY BENEFITS FOR PULL IMPLEMENTATIONS

Case Study Benefits	
Lucent Technologies Little Rock, AR	15% reduction in total materials management cost
Texas Instruments Lewisville, TX	35% reduction in total materials management cost
Lucent Technologies Guadalajara, Mexico	30% space reduction 50% reduction in material handling
Lucent Technologies Denver, CO and Shreveport, LA	35% reduction in inventory 5% reduction operating costs

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INVOLVEMENT IS THE KEY TO SUCCESS

Global Concept's Background
With FOSAT → SFL → Flow Planner

- **Active TLI research project for over 6 years**
- **Over 75% employees have been actively involved in FP research and/or implementations**
- **Continued research development through TLI membership and industry partners**
  - **Commonality**
  - **Demand characterization**
  - **Bin sizing**
  - **Transportation effect**

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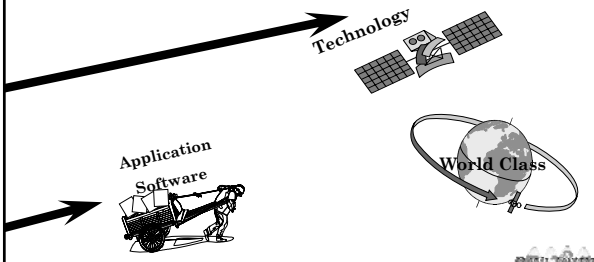
THE BUSINESS OPPORTUNITY

Today's technology combined with academic research in advanced logistic processes supports opportunities for B2B innovation



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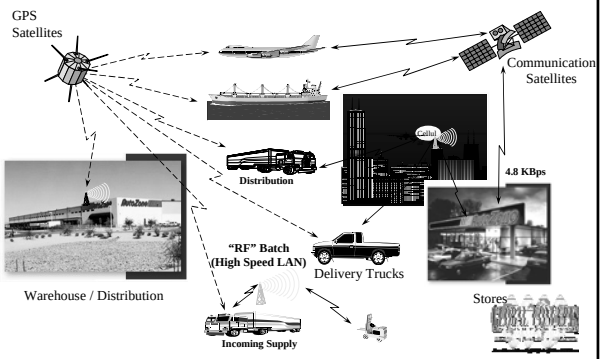
GLOBAL CONCEPT'S LOGISTICS VISION:

Establish an efficient "Virtual Warehouse" using "PULL Replenishment" techniques based on "Point-of-Sale" information



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VIRTUAL WAREHOUSE

GOAL

One world-wide system that carries out dynamic and continuous material logistics functions utilizing hybrid algorithms that perform at the efficiency and accuracy levels currently achieved only by world-class single location distribution centers.

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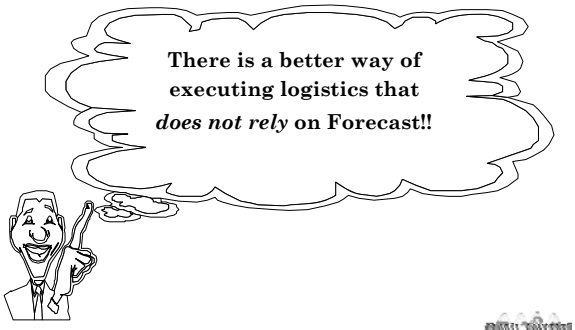
WHAT'S THE POINT?



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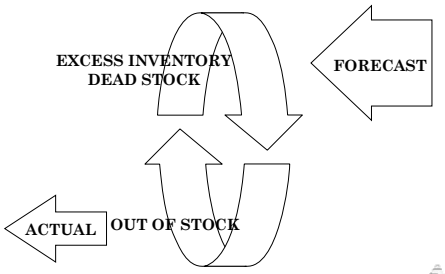
PLAN DOES NOT MATCH ACTUAL



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FORECASTING

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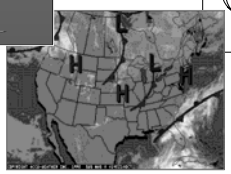

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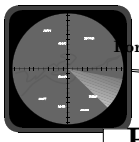
TRADITIONAL SUPPLY CYCLE



Forecast

Production Plan

MRP

Components

Storeroom

Suppliers

Distribution Center

Hybrid Push / Pull to Stores

Customer

PULL
Actual Demand

PUSH
Forecast Demand

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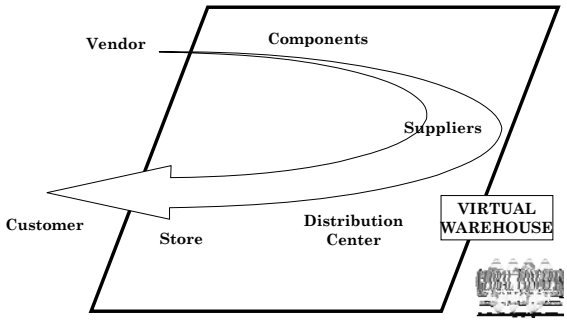
B2B EFFICIENCY THE VIRTUAL WAREHOUSE WAY



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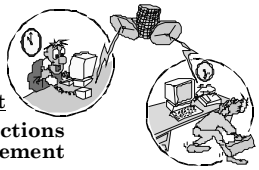
CHARACTERISTICS OF THE VIRTUAL WAREHOUSE



- Total Real-time inventory visibility and control
- True PULL replenishment
- No external system interactions for physical material movement
- Extreme material velocity
- Immediate sharing of demand data between B2B partners

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CHARACTERISTICS OF THE VIRTUAL WAREHOUSE

- Utilizing emerging technology, such as RFID, to lead industry in information management and logistics
- Postponement transportation
- Field decision support vs. Centralized management in life cycle logistics
- Cost effective competitive advantage

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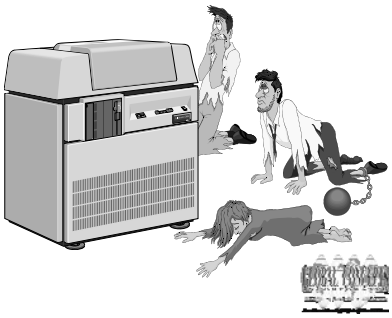
DANGER: HAVING PROCESSES BE SLAVES TO THE SYSTEM

- We've always done it that way
- The computer won't let me do it that way
- I am bound by the system



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YESTERDAY'S LOGISTICS PROFESSIONAL

- Responsibilities isolated to DC management & transportation
- Lack of good engineering tools & real-time, valid data
- Inappropriate metrics, not focused on full-stream process control
- Management level characterized by an inability to effect change at a strategic level

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TODAY'S LOGISTIC PROFESSIONAL

- All former responsibilities PLUS:
  - Customer service
  - Inventory control
  - Total asset management
  - Full-stream/ B2B management
    - Manufacturing production scheduling
    - Vendor management
    - Purchasing

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TODAY'S LOGISTIC PROFESSIONAL (con't)

- Competent in change management
- Master of technology
- Strategic logistics planning skills applied to achieve a competitive advantage
- <u>Top management position</u>

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Theme

Global's Logistics Suite

Flow Planner	Logistics Engine	Metrics Advantage
Design	**Execute**	**Measure**

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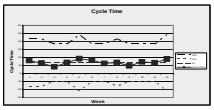
Design



- Logistics consulting
  - Both strategic & operational
  - Focus: process design/redesign, inventory reductions, customer service issues, and metrics
- Flow Planner
  - Cost based modeling tool
  - Focus: modeling of many common and advanced logistics problems
  - No known rival product
- Advantages
  - Speed, limited data requirements, and what-if capabilities
  - Expertly sets reference data for WMS

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FLOW PLANNER MODELING OPPORTUNITIES

- WMS reference data
- Lead-time reductions & consistency
- Flow-thru inventory
- Build-to-Order vs. Build-to-Stock
- Platforming/higher Commonality
- Storeroom design and inventory options
- Shop floor logistics design
- Vendor direct programs
- Consignment assessment
- Replenishment frequency analysis
- Final output buffers for shop scheduling

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Execute

- Logistics Engine
  - Advanced Warehouse Management System (WMS)
  - Design incorporates many best-in-class and world-class logistics processes and solutions (robust functionality)
  - Functions in distribution, warehousing, and manufacturing environments
  - Highly configurable handling many different verticals
- Advantages
  - Ease of implementation
  - Advanced diagnostics
  - RFID compatible

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Logistics Engine

PERFORMS…

- Ease of implementation
- Operational excellence
- In top 5% of WMS functionality*
- Highly configurable
- High end functionality at mid-range market prices

* Based on independent WMS industry ratings

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Logistics Engine

Installation…

- **0-60 in as little as 90 days**
- **Phased implementation strategies**
- **Data validation tools**
- **Certification training**
- **Small teams**
- **Self-directed installs**

© Global Concepts

Logistics Engine

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Logistics Engine

Operational Excellence…

- **Control Tower - provides complete facility visibility from a single computer enabling reduced management costs**
- **Diagnostics - detects issues before they become problems**
- **Advanced RF capabilities – boosts employee productivity and flexibility**

© Global Concepts

Execute

Control Tower

© Global Concepts

Logistics Engine

Configurability…

- Expert System - self educating with expanding capabilities
- Functions in manufacturing and distribution environments across many verticals
- Functions in both RF and paper modes
- Fluid configurability to individual level

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Logistics Engine

Functionality…

- Proven RF performance in excess of 1 M transactions per day
- Task interleaving
- More than six inbound methodologies
- More than twelve picking methodologies
- Tracks material, assets, and people

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Measure

- Metrics Advantage
  - Intelligent data warehouse based on information from warehouse management system that provides business insights
  - Enables root cause analysis
  - Provides labor management capabilities
- Advantages
  - Continuous improvement
  - Leading edge product currently ahead of the competition
  - Remote management and problem solving

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Clients

Tinker AFB

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Proven Results

- AutoZone
  - Increased throughput 200%
  - Decreased labor costs 20%
- Trane
  - Increased customer service from 70 to 90%
  - Decreased damage over 22% with vendor rating system
- FAA
  - Decreased labor costs 60%
  - Decreased fork truck fleet 80%
- Celestica
  - Decreased travel time 80%
  - Decreased labor costs 40%

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Future Releases

- Web Based Reporting
- Web Based functionality
- Hosted Solutions
- RFID Enabled
- Continued strong investment in joint R&D
- Achieve the Virtual Warehouse concept throughout our client's supply chain

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RFID

RFID (Radio Frequency Identification) is an automatic data collection method used to transmit information about an item.

ADVANTAGES

- Enforces discipline
- Real-time visibility
- Efficiency increases
- Information availability
- Additional information available without increase in cost
- Does not require line-of-sight

DISADVANTAGES

- Cost
- Read capabilities
- Unproven (wide spread)
- Lack of standards

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RFID Overview

- Tags / Readers
- Middleware
- Process integration
- Compliance
- Goals & Objectives
- Myths

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RFID Tag

Example
RFID/Barcode Tag

- Active tags
- Semi-active tags
- Passive tags
  - Class 0 – factory programmed
  - Class 1 – write once / read many
- Read / Write capabilities
- Depending upon volume, passive tag cost will range from thirty cents to one dollar with active tags ranging from two to three dollars to well over fifty dollars per tag

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RFID Label Selection

FACTORS IMPACTING READ DISTANCE

- Orientation
- Product environment
- Size of antenna
- Antenna placement
- Label construction and durability
- Composition of product/packaging
- Dwell time

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RFID Middleware

MIDDLEWARE

- Controls duplicate reads
- Interfaces to multiple brands of readers/tags
- Recognizes both active and passive tags
- Standard interfaces to most common ERP/WMS systems
- PML capabilities
  - May not be used by Wal-Mart
- XML enabled
- Most are open source
- Exception handling
- Business rules

COMPANY SOFTWARE

- Controls duplicate reads
- Custom interface required
  - Other brands
  - Active tags
  - ERP/WMS systems
- Does not support PML
- Limited XML capabilities

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Process Integration

- Develop detailed business case including
  - Product flow
  - Environment conditions
  - Human interaction
  - System touch points
- Clear understanding of Wal-Mart/DoD and EPC Global requirements/compliance issues
- Product physics and testing requirements
- Integration with existing systems and technologies
- Pilot

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Wal-Mart Compliance

- Tag cartons and pallets
- Require 96 bit tag coded with EPC #
- Leaning toward utilization of UCCnet infrastructure
- Case – conveyor speed up to 600 fpm
- Pallet – two side antenna, one overhead, handheld
- All existing tag requirements still apply
- Tag and reader types specified
  - Any UHF EPC compliant tag
  - Future is class 1 version 2

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Goals & Objectives

PURPOSE

- Compliance with Wal-Mart and/or DoD mandates
- Internal improvements
- Integration with Wal-Mart and/or DoD

ROI OPPORTUNITIES

- Material handling efficiencies
- Product recall
- Stock rotation
- Asset management

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Keys to Success

- Establish a detailed business case
  - Poor level of detail is the primary reason many first implementations fail
- Build a practical implementation roadmap
  - Continually adjust as new information becomes available
- Conduct rigorous proof of concept testing
  - Lab environment
  - Real world situations
- Pilot the proposed solution
  - Real world environmental testing
- Rollout based on ROI considerations
  - Consider both short and long term impacts
- Training and change management

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RFID Myths

- A single tag and reader can normally accommodate multiple product lines
  - Normally, there is not a one size fits all solution, but a combination of tags/readers requirements for varying product lines
- The additional data that RFID collects provides an immediate payback in many cases
  - While this can be true, it depends on the organization's capabilities to manage the data and translate it into information that management can use for decision making
  - Normally involves system's integration and/or data mining tools to achieve the benefits

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RFID Myths

- The reduction in material handling costs associated with automatically reading the product can provide large payback in many cases
  - While this can be true, a robust warehouse management system already provides many of these advantages in the traditional barcode environment
- RFID tags will eliminate the need for barcodes within our supply chain
  - While this may be true in the future, expect barcodes and RFID to co-exist for many years due to the limitations and cost of the tags

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Global Concepts Offering

Integrators – utilize the new technology and incorporate it into your supply chain

- **Supply chain experts**
- **Proven understanding of RFID, RFID application, and compliance requirements**
- **Existing relationships with RFID technology providers**
- **Knowledge to create successful roadmap for RFID implementation**
- **Experience integrating new technologies and supply chain processes**

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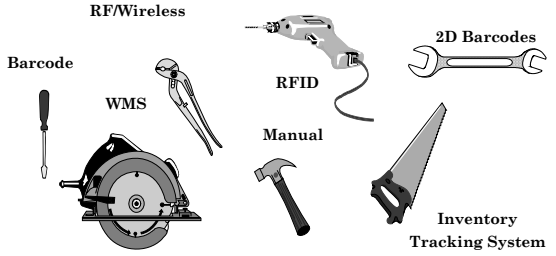
Logistics Toolkit

Data Collection/Transfer



Process requirements dictate the appropriate use of each technology…

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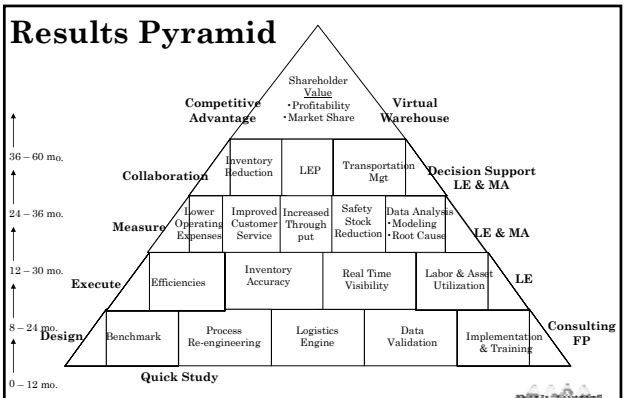
Results Pyramid



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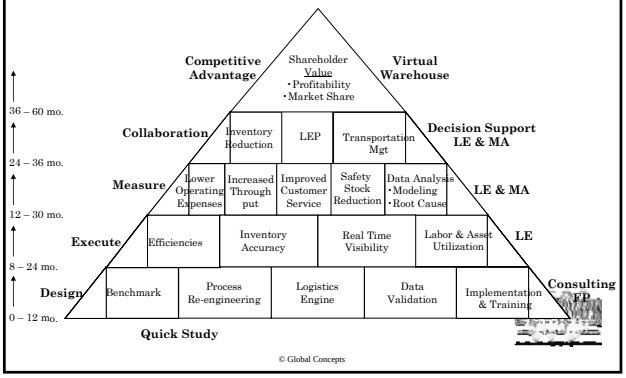
Results Pyramid – Consulting



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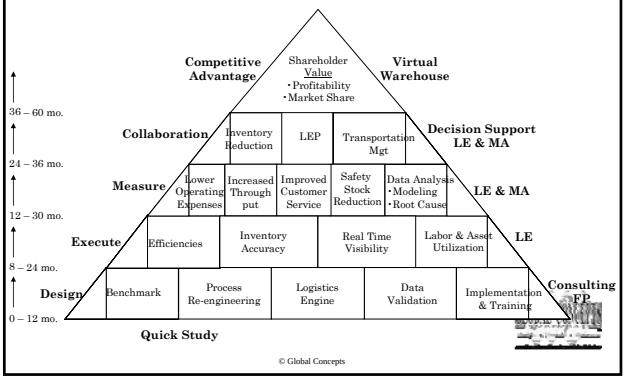
Results Pyramid – Systems



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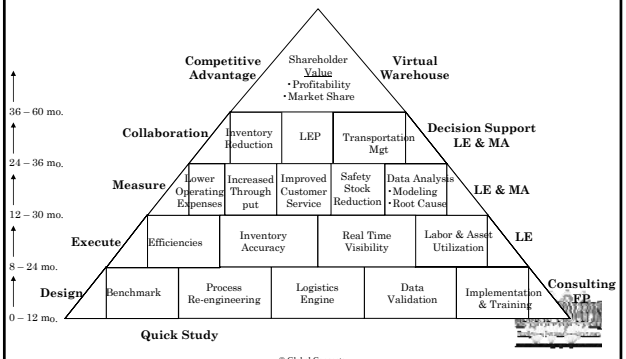
Results Pyramid – Functionality



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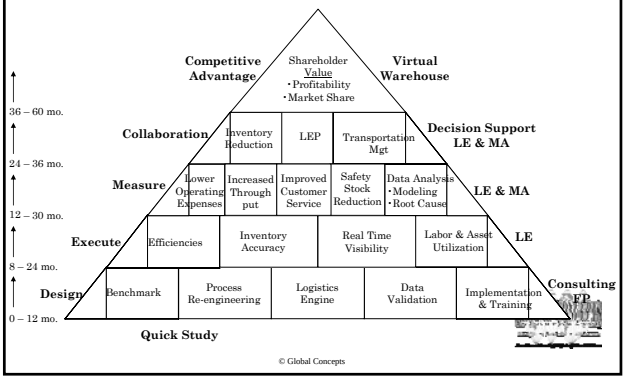
Results Pyramid – ROI



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Opportunities

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Opportunities

- Customer Service
- Inventory Accuracy
- Lower operating expenses
- Throughput
- Visibility
- Labor/Asset Utilization
- Training
- Installation

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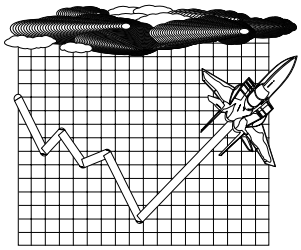
BOTTOM LINE: Real-Time Shared Information Enables...

- **VELOCITY & ACCURACY in the logistics pipeline: lowering inventory and increasing profits for all involved**
- **Establishing an efficient virtual warehouse in PULL mode supporting a high level of customer service at the lowest cost**



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