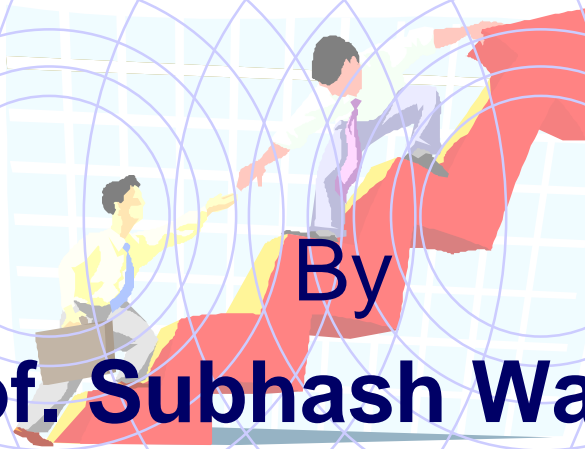


# Architectural Challenges Within Extended Enterprises

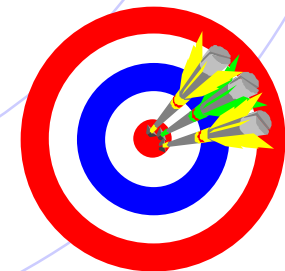


By

**Prof. Subhash Wadhwa**

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# Brief Introduction

(Prof. S. Wadhwa, Eur. Ing., C.Eng., Phd)

- **INDIA**

Professor, Faculty IIT, New Delhi

~ 13 years

Indian Industry

~ 2 years

- **EUROPE**

PhD: CIM System Domain

~ 4 years

European Strategic Program on Research in IT (ESPRIT) ~ 6 years

- **US Multinational**

CIM Engineer : Digital Equipment Corporation

~ 2 years

Knowledge Engineer : AI Program for Strategic Planning

- **IT in Manufacturing: Industry-Institution Efforts**

Chief Consultant / Principal Investigator/ National Expert, Coord. EU-India,  
Coord. Indo-French (CIMMEM), CW, UNIDO, APO (Tokyo), EC etc.

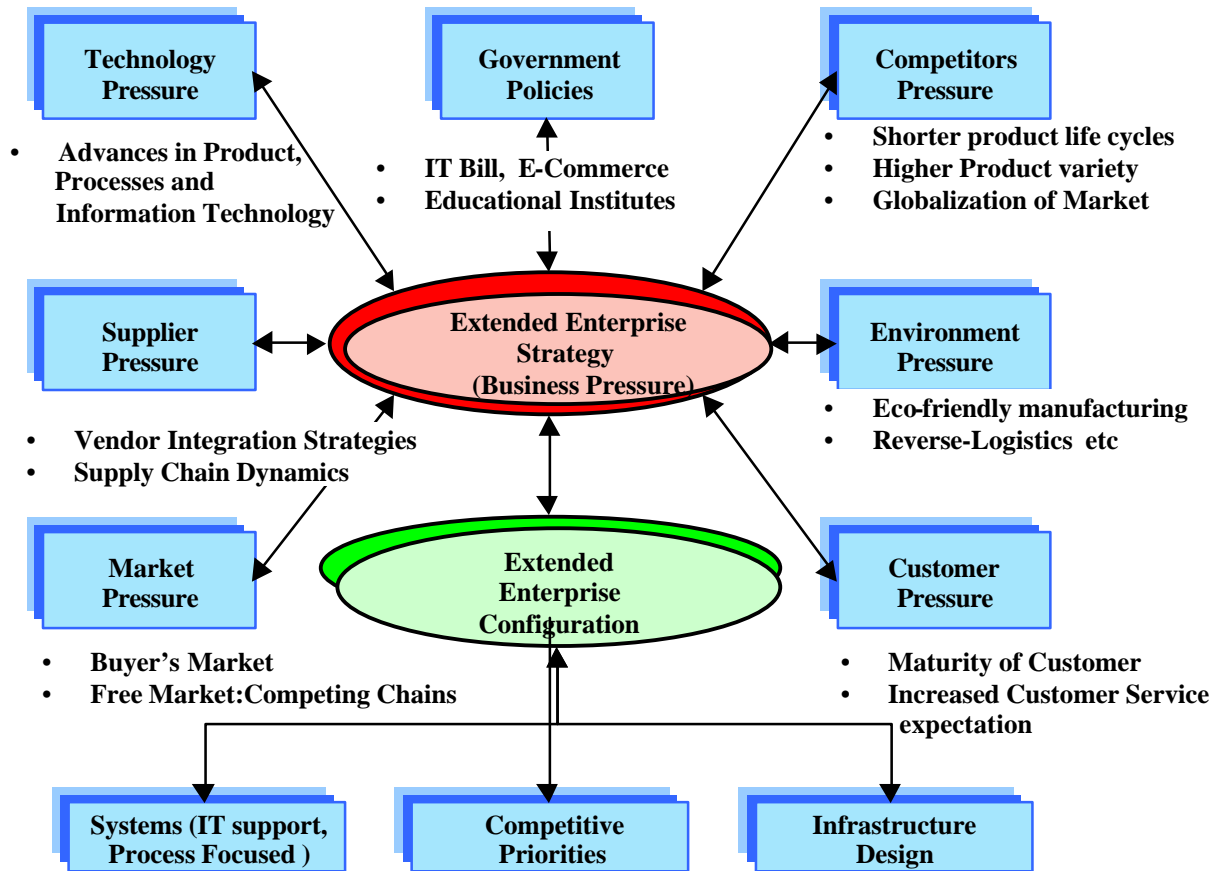
- **Publications** : Over 100 incl. Int. Journals IJFMS, IJPR, IJTM, SIC etc

- **Interests** : CIM Enterprises, ERP, EE, SCM, EM, KM, Sim. & AI etc.

- **Career Goal: Synergy Between Academics, Industry, Research**

# Presentation Outline

- New Competitive Challenges
- Need for Architecture Evolution
- Architecture Challenges
- Towards Extended Enterprises
- Collaboration : Global Supply Chains
- Entity Flow Synchronization (DIS)
- Knowledge Management Perspective
- Outlining the Architectural Challenges
- \* Conclusions

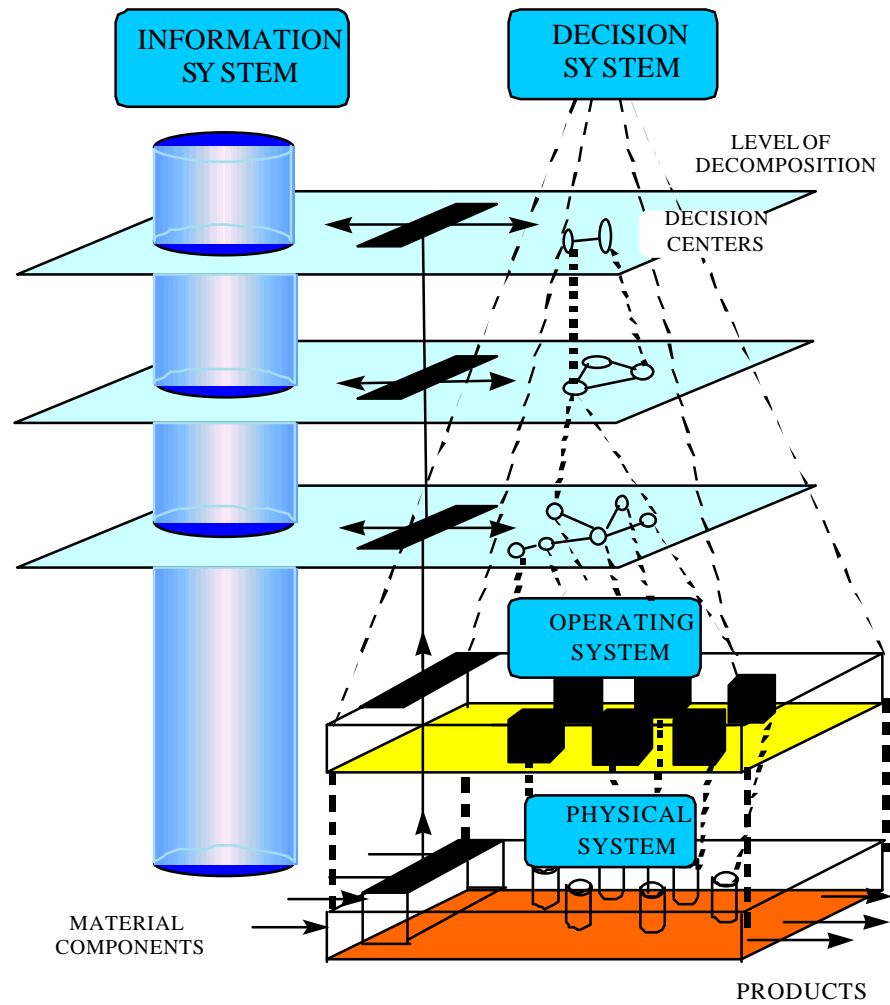


# Changes in Business Environment

# Competitiveness: Evolving Challenges

- **Competitive Factors (Multi-Attribute Competition)**
  - Cost, Quality --- Variety, Lead Time, Delivery on Time..
  - Access to Information --ordering, maintaining, end-of life
  - Eco-Friendliness, Safety -- Reverse Logistics
- **Time Based Competition in Flexible Systems (IT Focus)**
- **Key Challenges (Directional Priority Changes in Systems)**

Efficiency	to	Flexibility and Efficiency
Local Performance	to	System Effectiveness
Partial Productivity	to	Total Productivity
Mass Production	to	Mass Customization
Competing Firms	to	Competing Chains (EE)
- **A New System Focused Knowledge (KM) is Critically Needed**
- **Judicious Use of IT in Business Enterprises .. Value Chains**
- **IT Facilitated Extended Enterprises (Seamless Integration)**

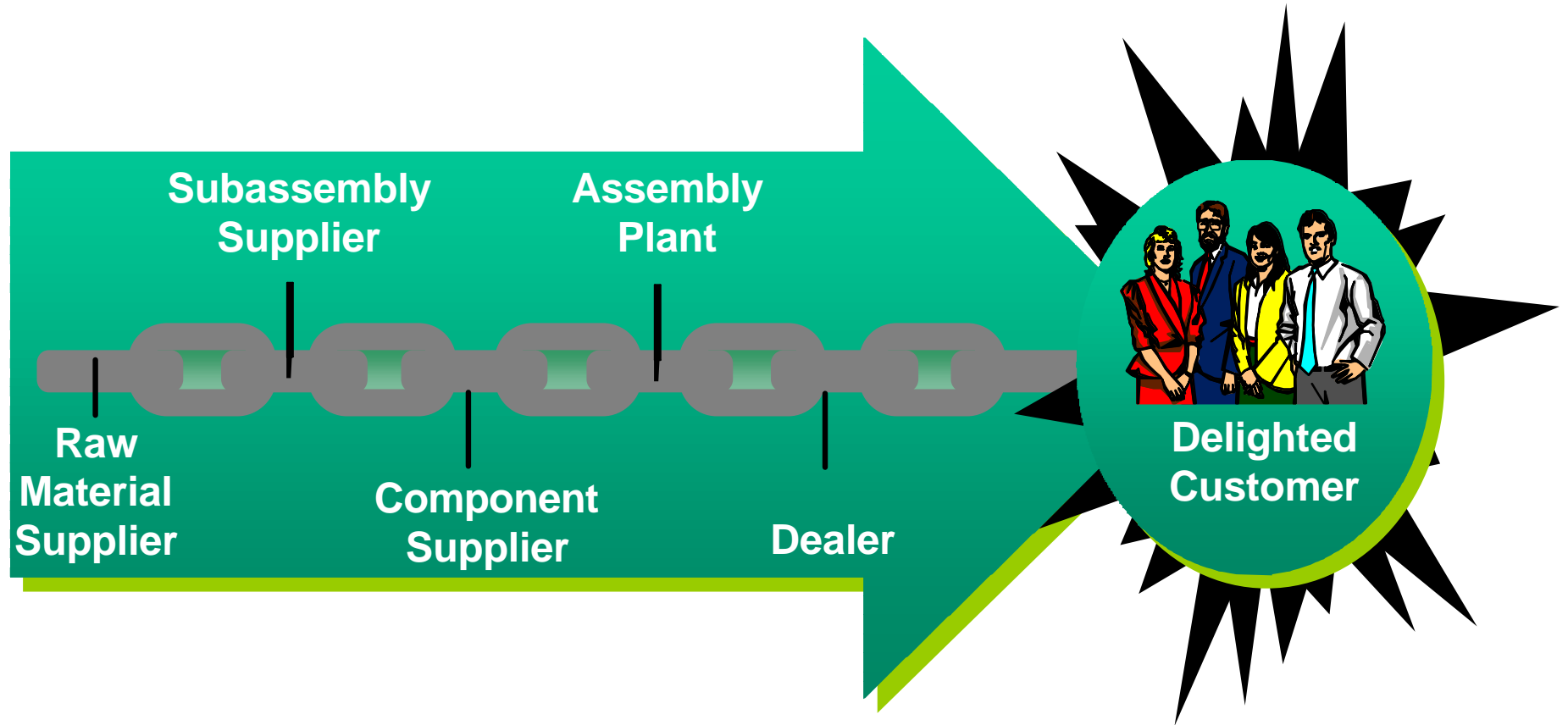


## EM : The GRAI Macro Reference Model

# Architectural Challenges

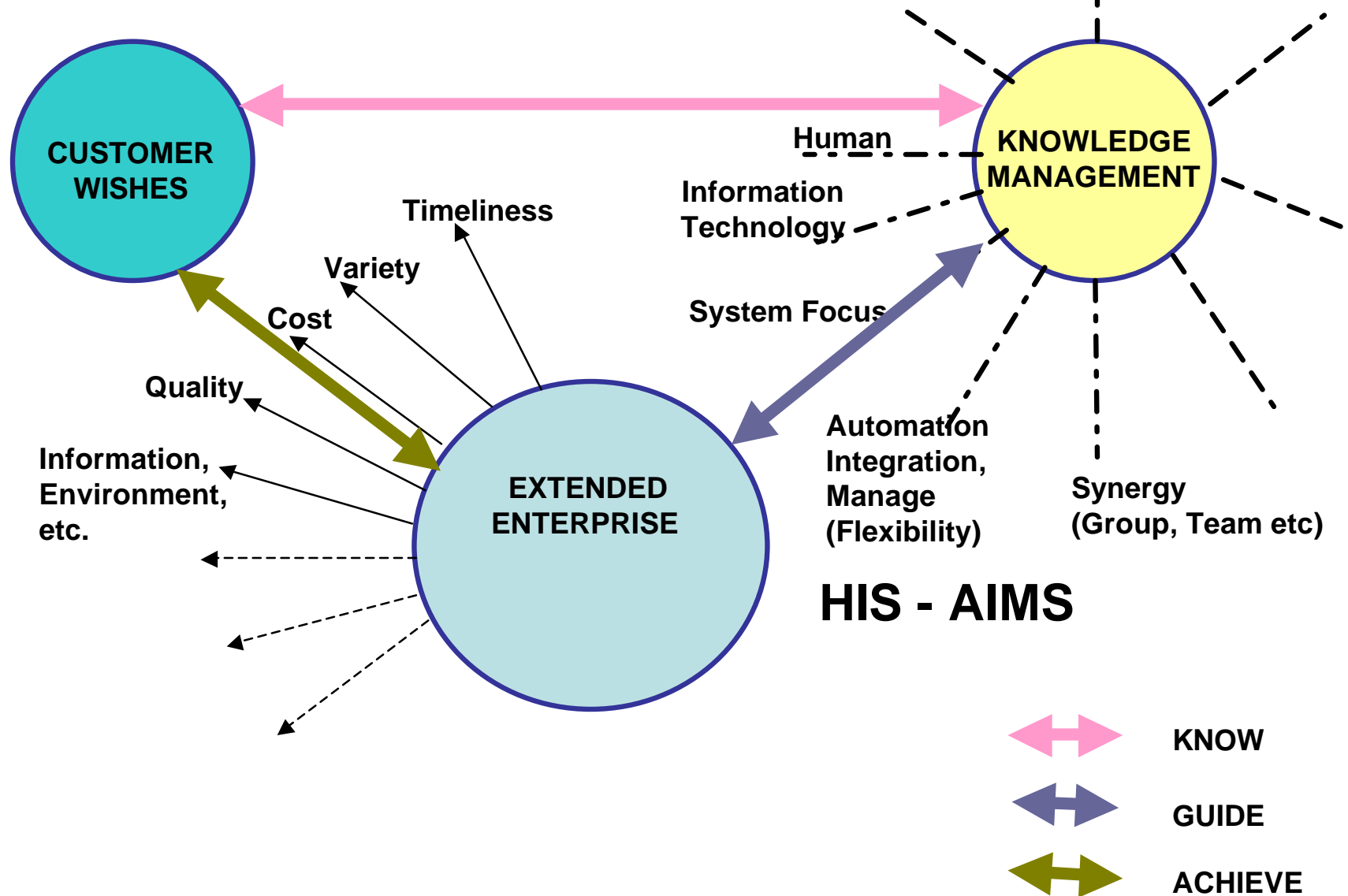
- Towards Extended Enterprise: New Needs
- Decision and Information Delays (DIS)
- Multiple Flow of Multiple Entity Types
- Enterprise Synchronization with DIS
- Flexibility, Integration, Automation : Synergy
- Phased Implementation of IT Solutions
- Collaboration: Global Supply Chains
- Sequential .vs. Concurrent Decision Making
- Knowledge / Innovation Management Facilitation  
etc.

# The Extended Enterprise Supply Chain

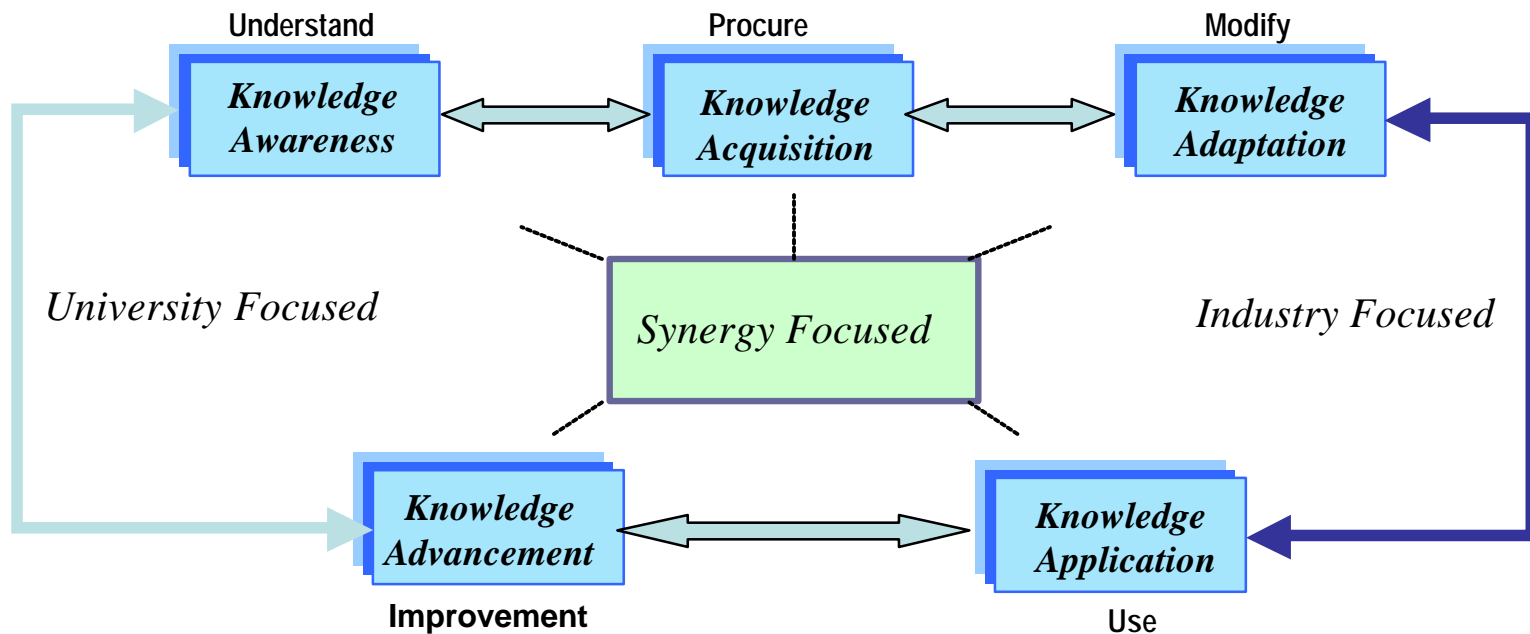


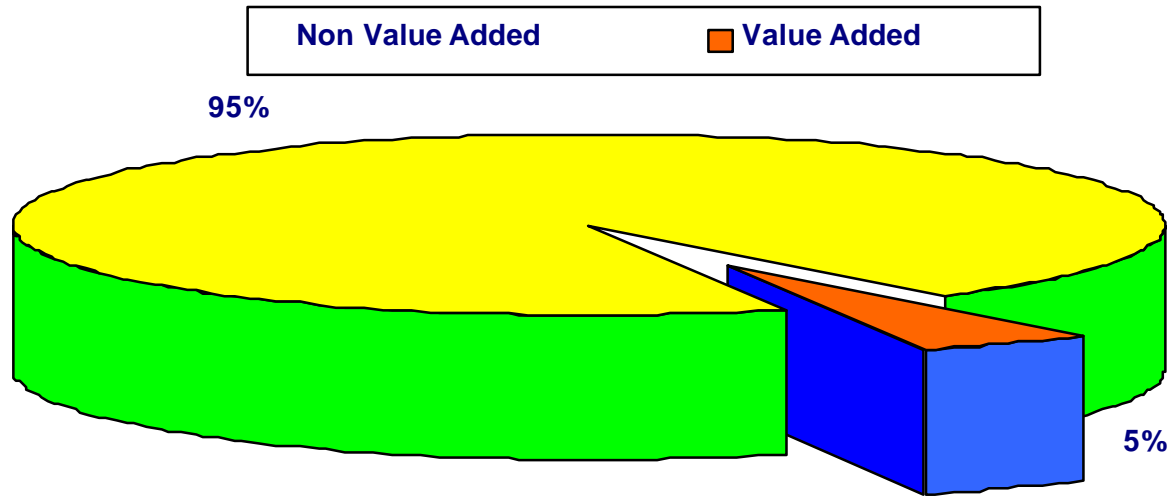


# Knowledge Management In Extended Enterprise Context



# Knowledge Management (KM) Framework (Synergy Focus: Extended Enterprise)





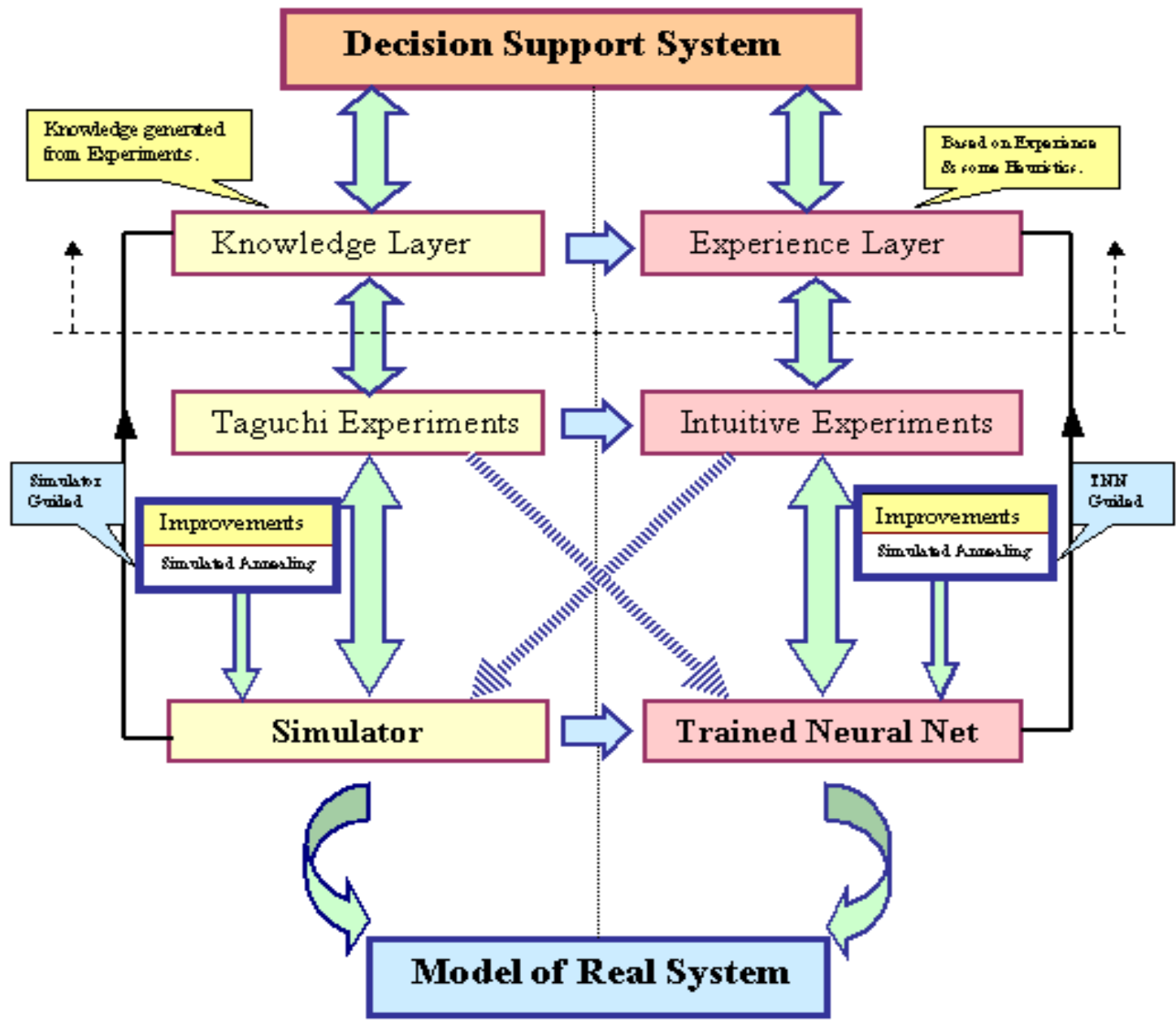
**Analysis of Lead Time**  
**Non Value Added Time vs. Value Added Time**

# Knowledge: Important Changes

- Mass Production to Mass Customization
- Utilization Focus to Lead Time Focus
- Function Orientation to Process Orientation
- Local Efficiency to System Flexibility & Efficiency Focus
- Sequential Decisions to Concurrent Decisions
- Best Single Design to Best Alternative DFM Solutions
- VAT Increase Goal to NVAT Reduction Goal
- Internal SME Integration to Supply Chain Integration
- Cost Based Competition to Multi-Attribute Competition
- Automation focus to Re-Engineer - Flexible And Agile

**Challenge Towards Effective Extended Enterprise**

System Focus, IT, Flexibility, Integration, Automation



**The Architecture of the System**

# **Extended Enterprise Concept**

- **Integration of enterprise business processes, functions, and software applications from end to end - including not only internal operations but also entire supply/service chains.**
- **Extension of enterprise outwards to enable collaboration with customers, employees and business partners in connected economy.**

# Definitions

A coordinated, goal-driven process that unifies and extends the business relationships of suppliers and supplier tiers to reduce cycle time, minimize systems cost and achieve perfect quality.

“Extended enterprise”, an ultra-connected corporation that can communicate with suppliers, customers, employees and partners in real time, anytime ,with vision closer to reality.

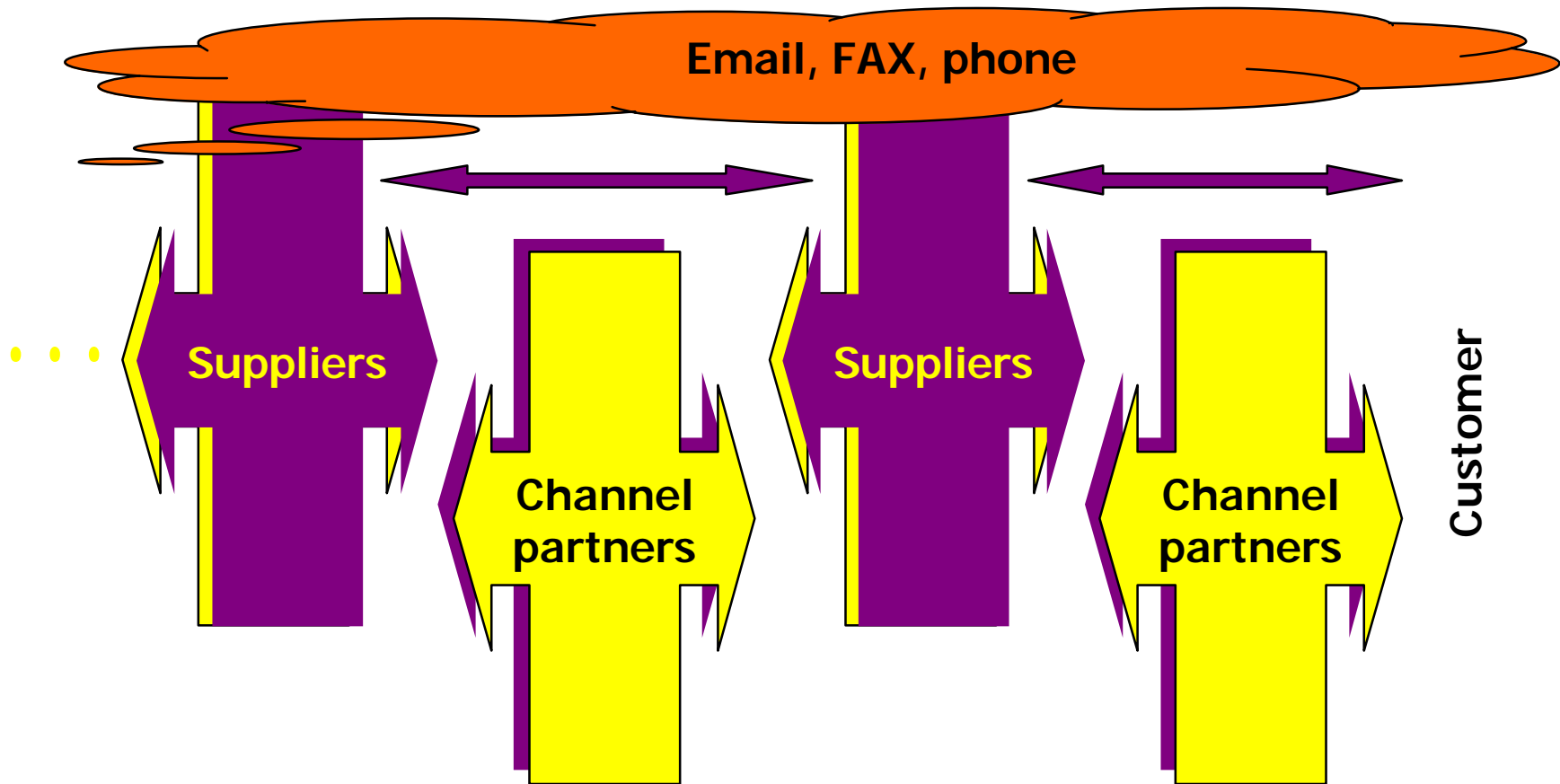
# Extending Coordination...

- **Some Experts View EE as Extended Coordination along a Value Chain..**

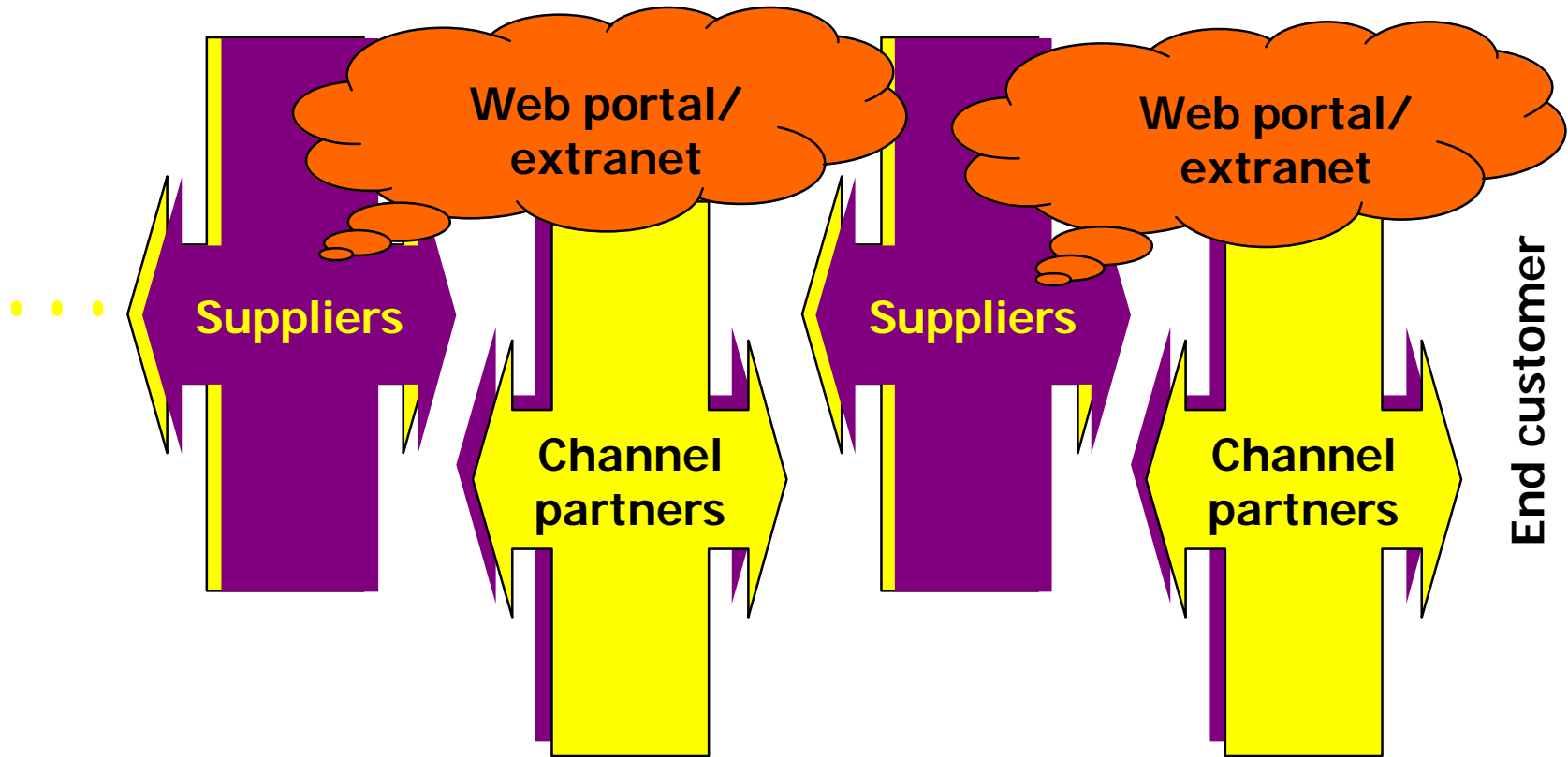
“Extended Enterprise is the formation of closer co-ordination in design, planning, development, costing and co-ordination of the respective manufacturing schedules of co-operating independent manufacturing enterprises and related suppliers “



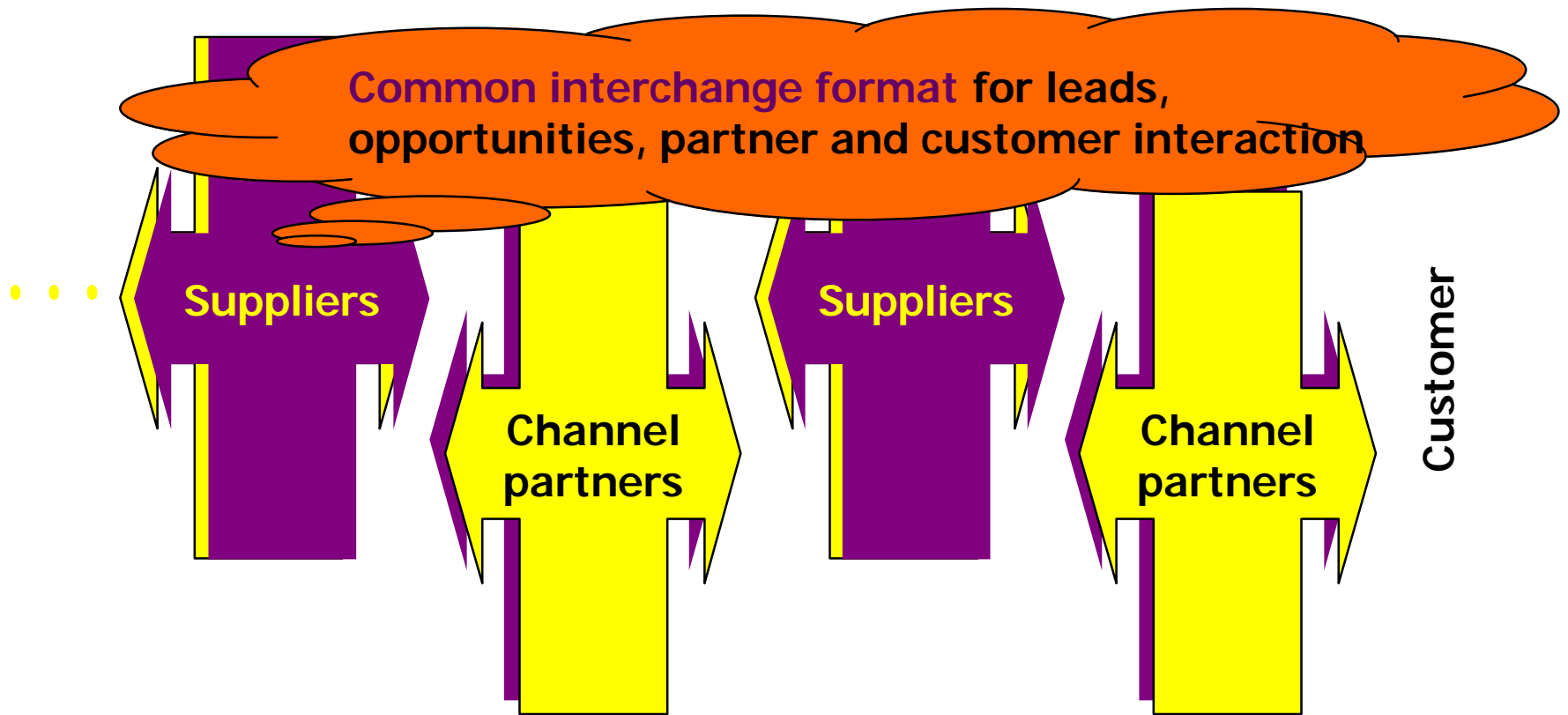
# The old world



# What's being built...



# What's really needed...



# New Mindset

- The core concept of the Extended Enterprise is that “the Extended Enterprise can no longer treat their suppliers and customers as **them**, they are all now part of a larger **us**”.
- In the global marketplace, the Supply Chains are competing to give best value to the **changing customer needs**.
- Globally, the customers are looking for Improved **Coordinated** Chain Performance, Not one great performer and others weak.

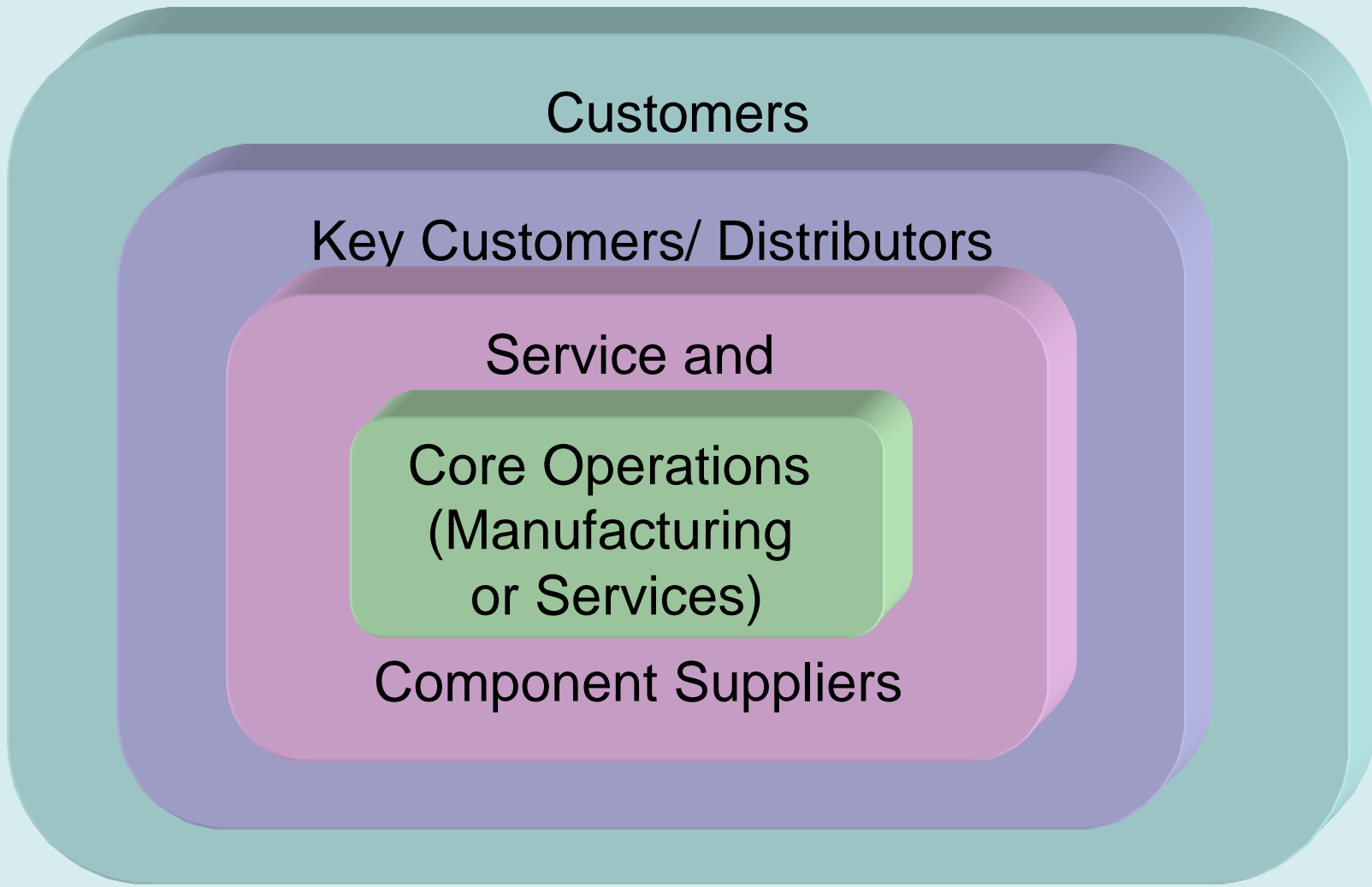
# Collaboration Focus

- **Extension of enterprise outwards to enable collaboration with customers, employees and business partners in connected economy.**
- **Collaboration must lead to a win-win situation.**
- **The conflicting Objectives need to be resolved towards common enterprise objectives.**
- **Collaborative Decision Models well supported by Information need to be in place**

# Challenges

- Evolving Focus: Whole lifecycle of the product
- Partnerships: long term, relatively stable
- Demand More decision-information sharing.
- IT is a Key Enabler and Interoperability Crucial
- Re-engineering the new enterprise processes.
- Extended Enterprise Architects: ICT Challenge

# EE: Dissolving Boundaries



# Why Extended Enterprise

- Remain Autonomous, Focus on Cooperation.
- Simplify, Improve Value, Improve "agility",
- Improve the Total System Performance.
- Streamline the infrastructure management
- Increase productivity and deliver better customer service by focusing on entire chain.

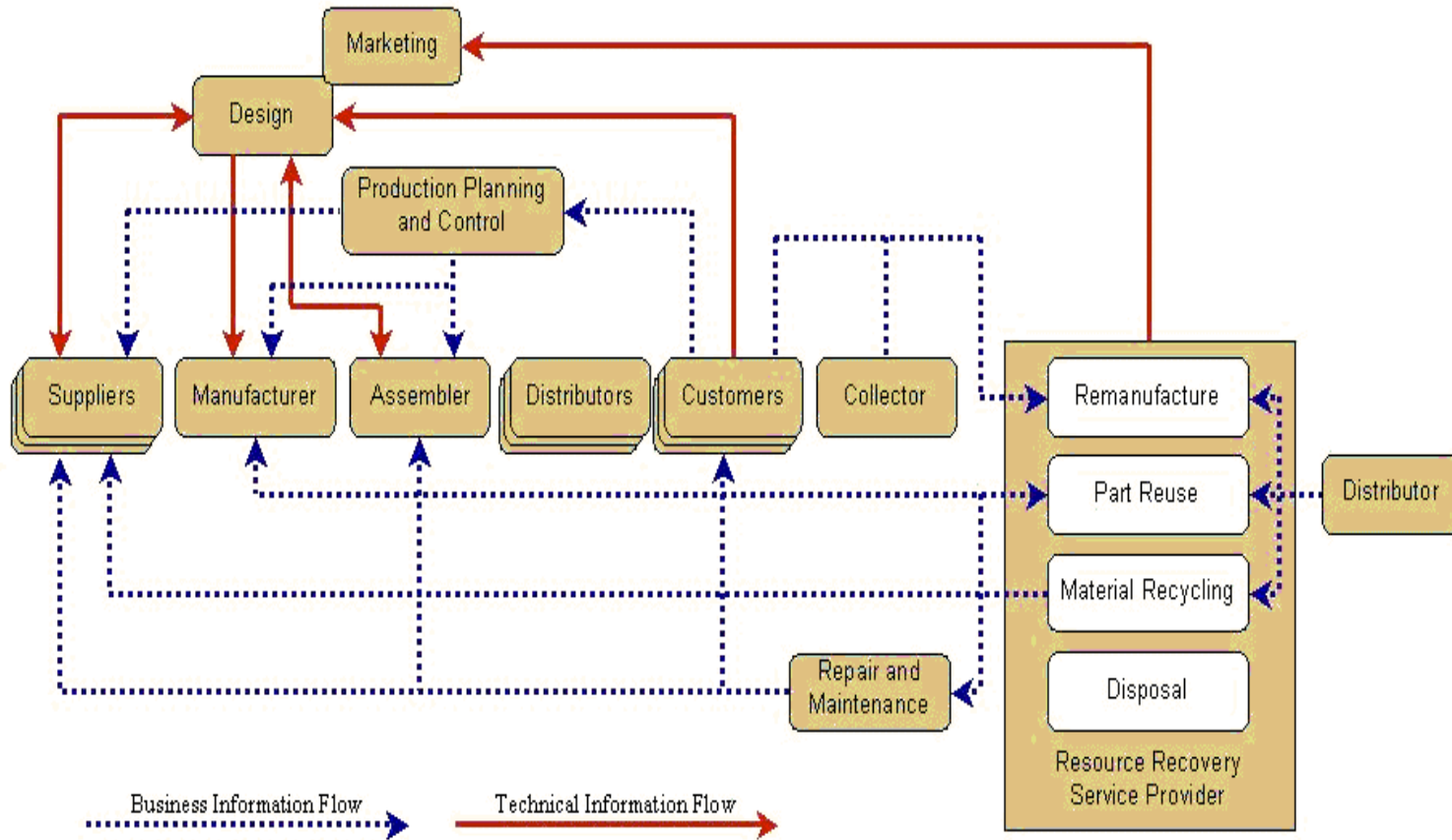


# Challenge: Integrating the 5 C's in Extended Enterprises

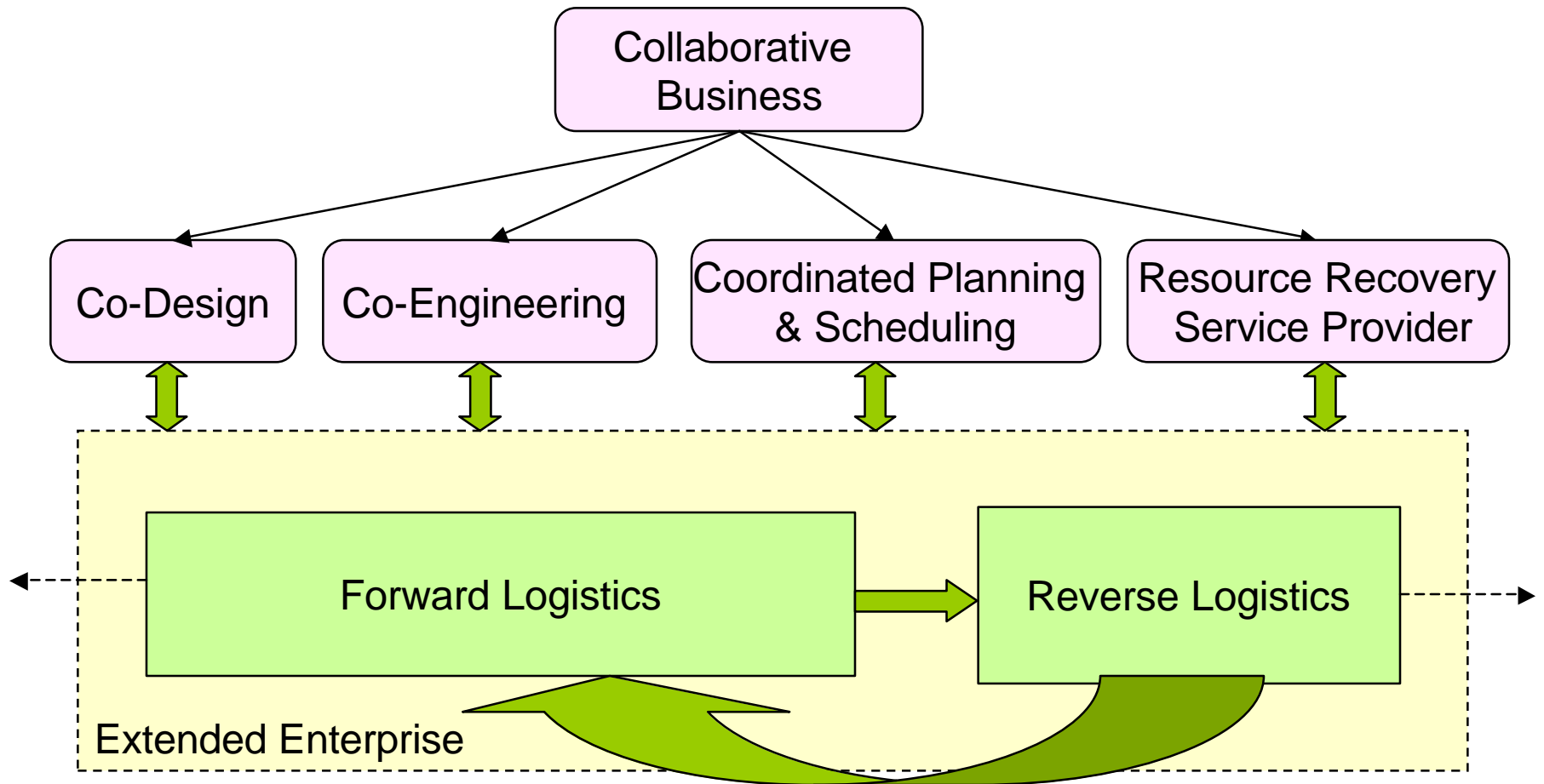
- **Coordination:** Partners coordinate activities
- **Cooperation:** Conflicting Objectives are resolved with cooperation focus
- **Collaboration:** Joint Decisions. Win-Win Focus
- **Community :** Shared norms and expectations, shared vision, values, roles, rules are jointly set.
- **Connectivity :** Seamless and Transparent information flows... IT is an enabler

**New EE Focused on Customer Value Evolves**

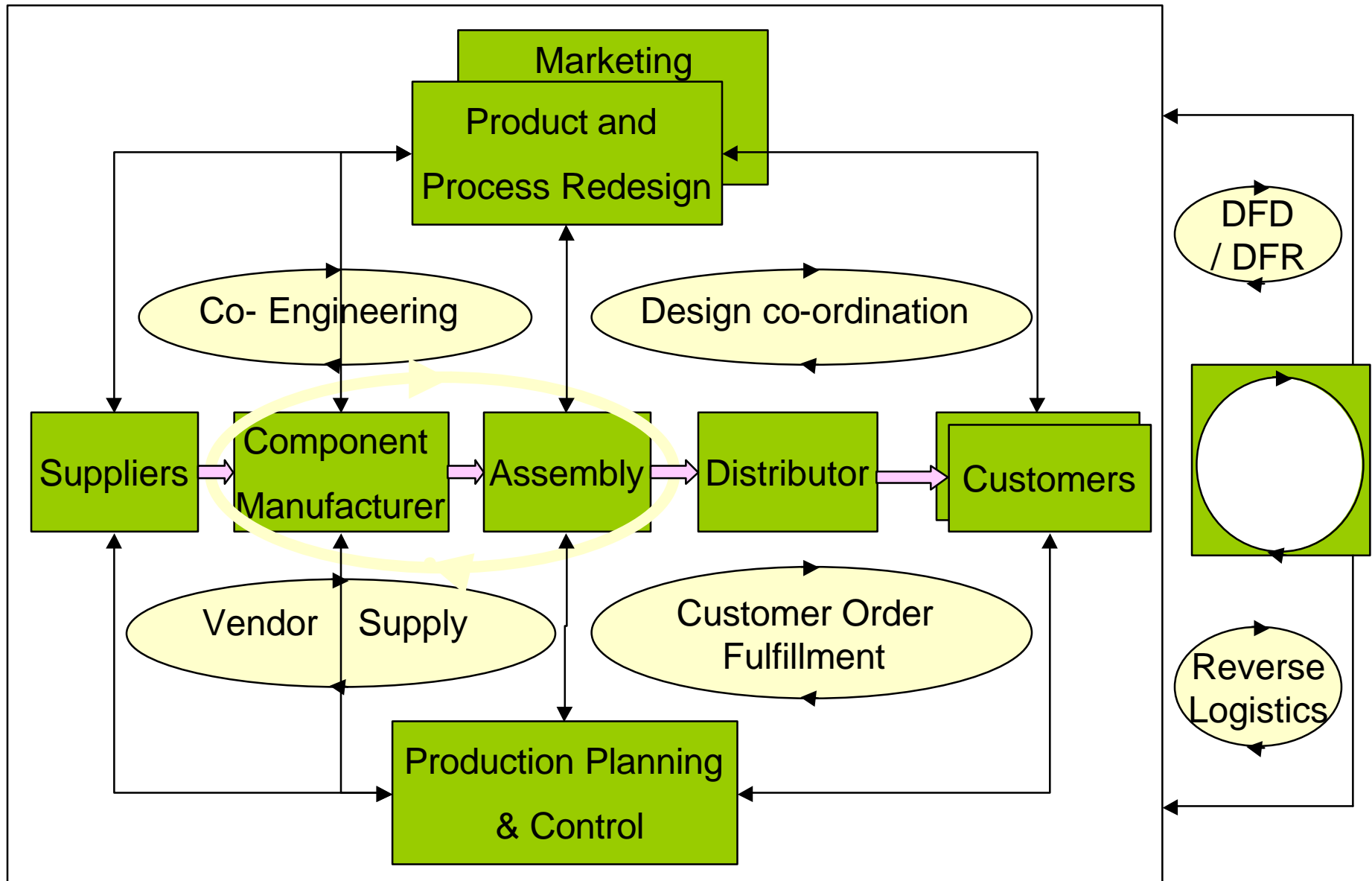
# EE: Expanding Domains



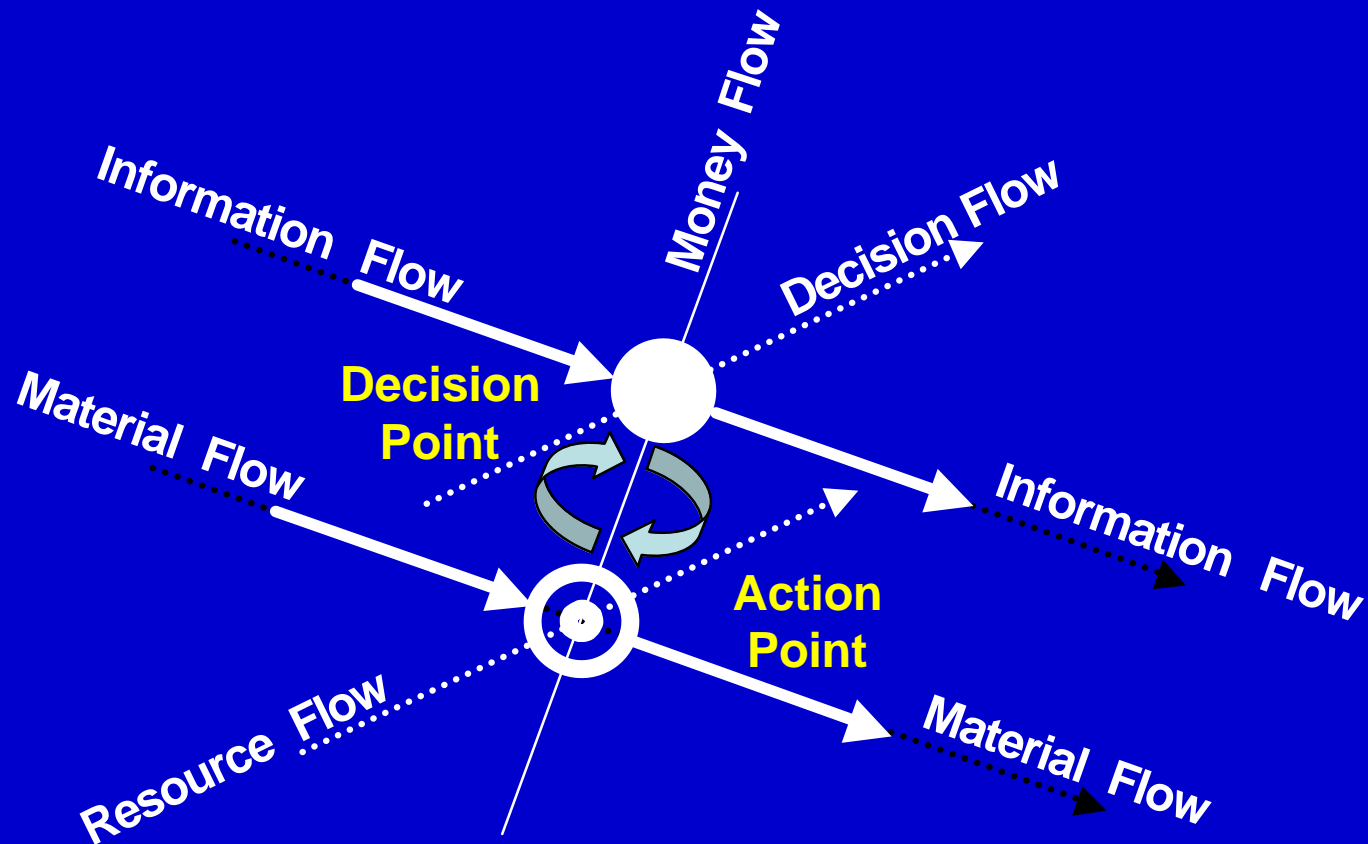
# Collaboration Challenges



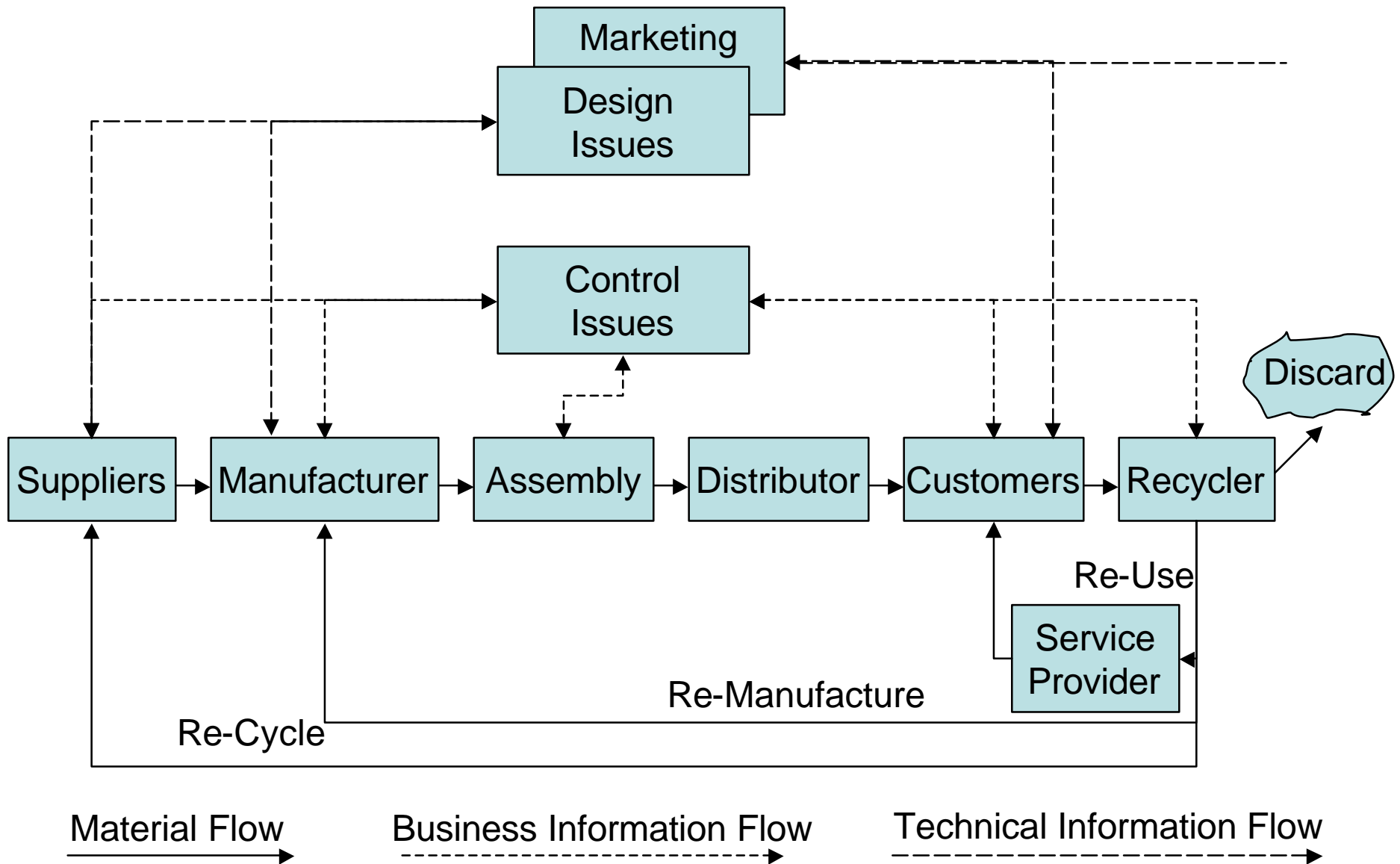
# Focus on Business Processes



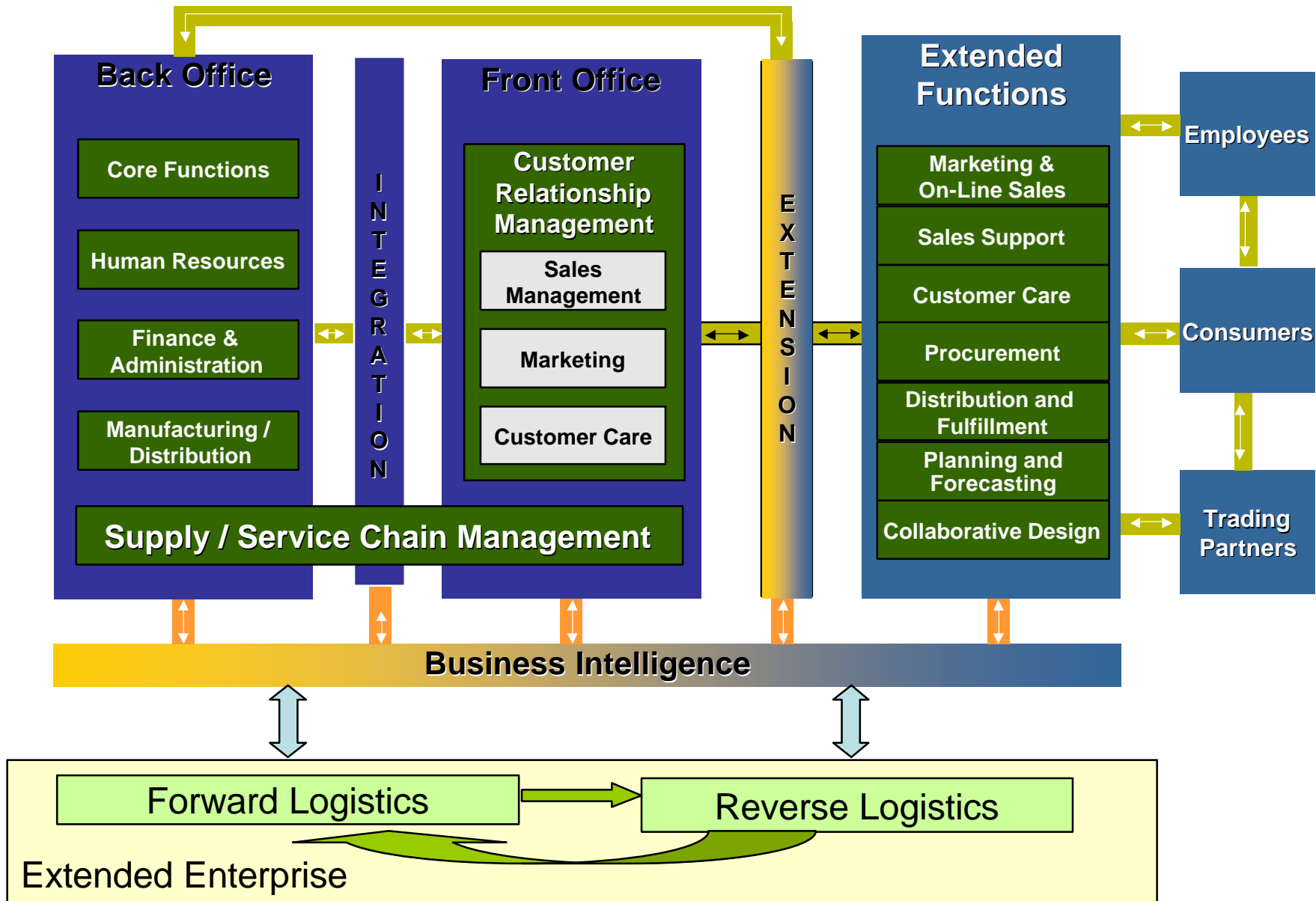
# A Multiple Entity Flow Perspective



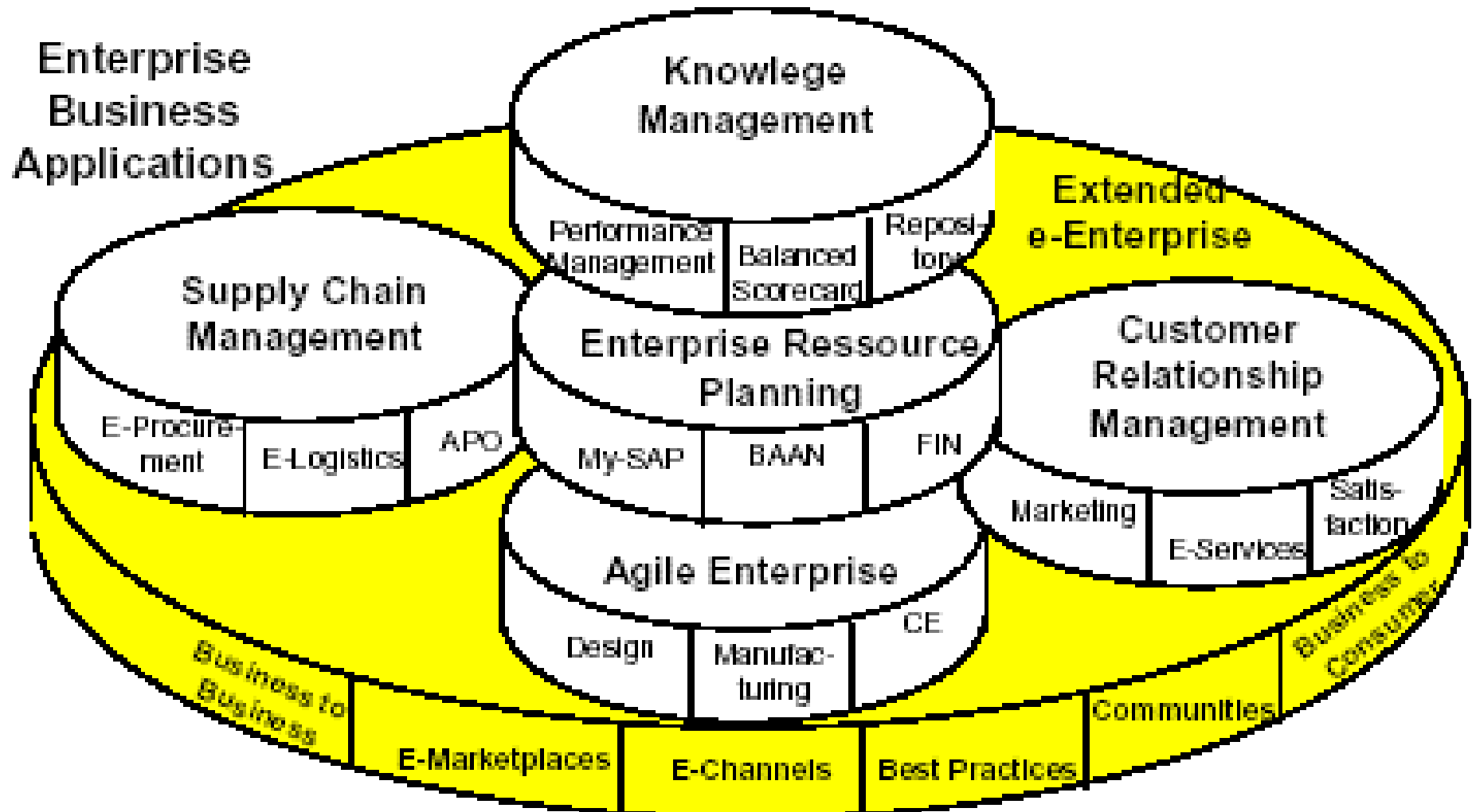
# Multiple Entity Flow Focus



# Extended Enterprise Model



# Extended E-enterprise



Extended Products in Dynamic Enterprises: The IST Project Cluster EXPIDE

Bernd E. HIRSCH AND Jens ESCHENBÄCHER

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# Extended Enterprises Vs Virtual Enterprises

	<b>The Extended Enterprise</b>	<b>The Virtual Enterprise</b>
<b>Strategic issue</b>	Strong long-term objective	Strong short-term objective
<b>Partnership purpose</b>	Long-term business co-operation	Temporary working together for projects or products
<b>Organization stability</b>	Stable organization of companies across the product value chain	Dynamic organization of companies with core competence
<b>Partnership relationships</b>	Trust and mutual dependence for long term	Temporary and dynamic

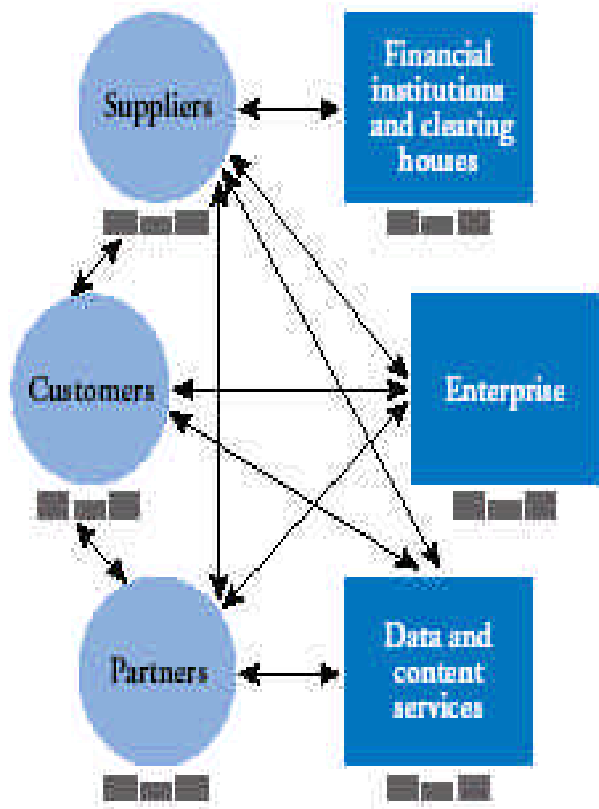
# Extended Enterprises Vs Virtual Enterprises

	<b>The Extended Enterprise</b>	<b>The Virtual Enterprise</b>
<b>Boundaries</b>	Full blurring for long term	Partly blurring for short term
<b>Organization type</b>	Product value-chain based	Frequently project or niche market based
<b>Co-ordination of partnership</b>	Usually the manufacturer manages the partnership	Frequently a broker manages the co-operation
<b>Information and communication technology (ICT)</b>	Facilitated and enabled by ICTs	Operation depends on sophisticated ICTs

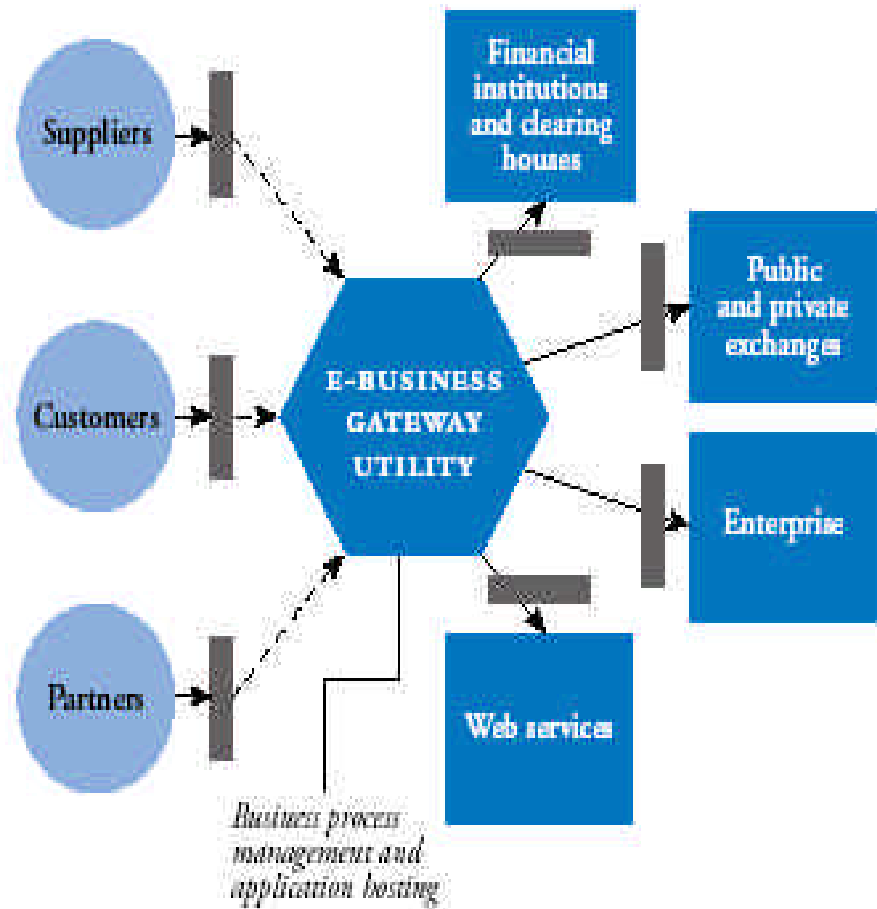
# Issues in Extended Enterprise

- Reduced product life cycles: therefore increased flexibility required
- Time-based competition: need to reduce the time to market for the new products
- Total product life cycle view: necessary due to heightened awareness of environmental problems
- Creating organizations and systems which attract high quality people
- Developing an manufacturing strategy: which is appropriate to the business environment and takes account of the position of the position of the manufacturing in the value chain

TODAY'S TECHNOLOGY ENVIRONMENT

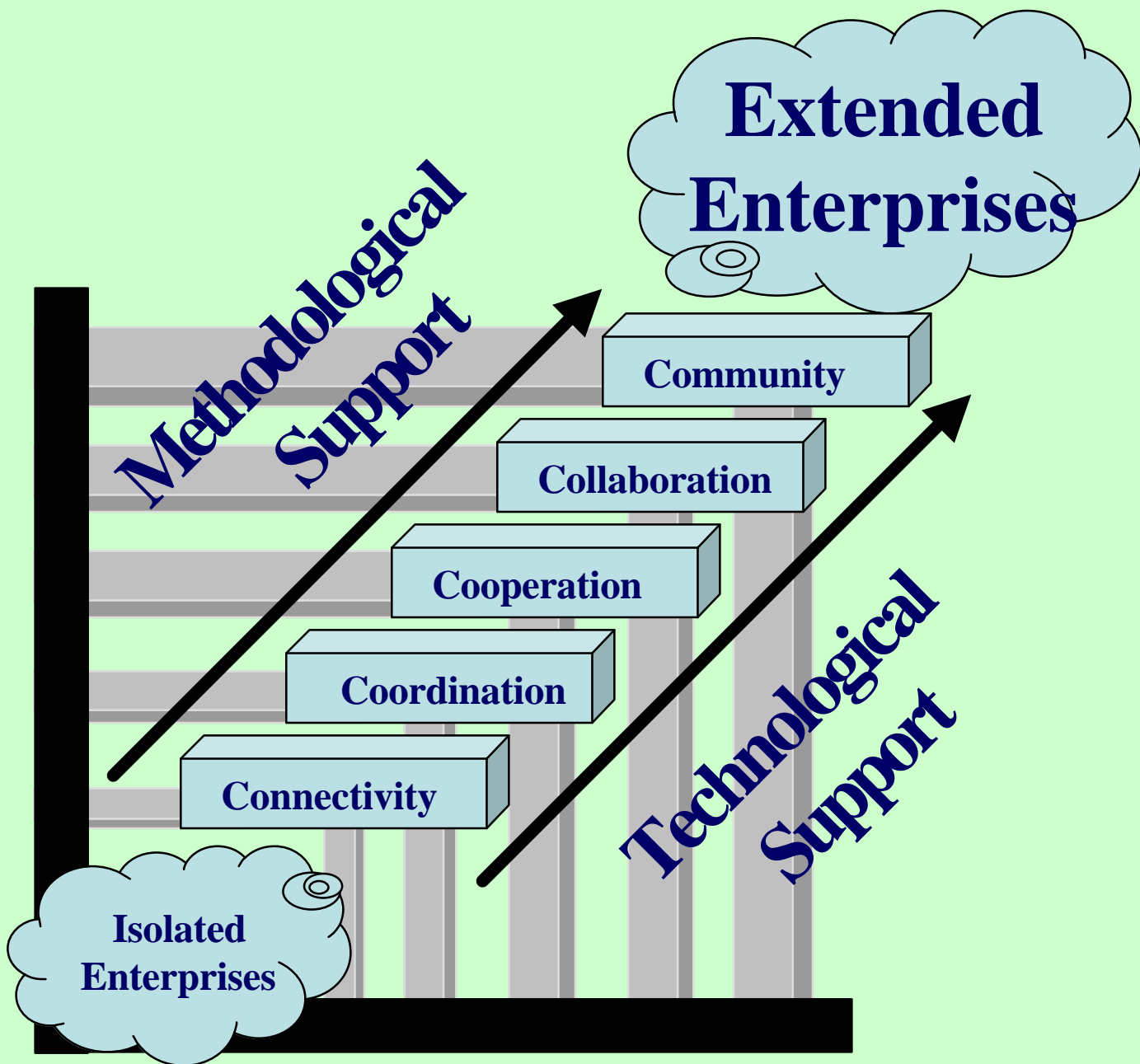


TOMORROW'S TECHNOLOGY ENVIRONMENT



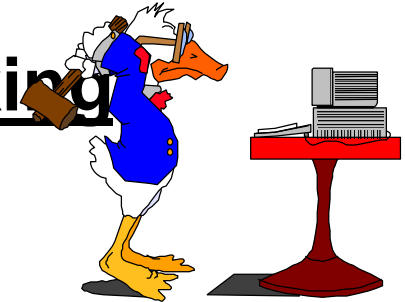
■ ■ ■ Stand-alone applications

■ Adapters





# Collaboration in Decision Making



## Example : Flexible Resources Allocation

Sequential Decisions .vs. Integrated (Global Decisions)

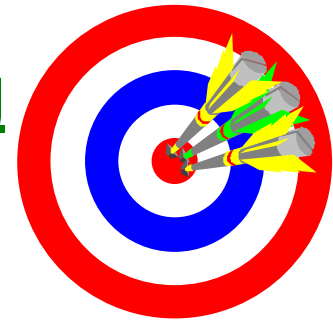
Situation: Flexible Module Options : F1, F2 and F3

Basic Goal Requirements : G1, G2 and G3

Suppose we want all Requirements to be Fulfilled by dedicating one Flexible Module to One Basic Requirement.



# Integrated Decision Making



- Cost Matrix (In Thousands of \$)

	G1	G2	G3
F1	50	15	9
F2	20	7	3
F3	18	5	16

Expected Benefit: 45,000 \$

- A Sequential Decision Process
  - Pick the first least cost option - F2-G3
  - Pick the next least cost option - F3-G2
  - Pick the next available option - F1-G1
- What is the best collaboration for EE with F1, F2, F3 ??

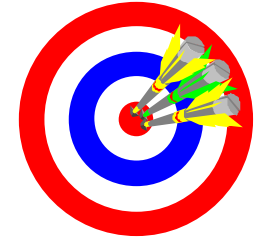
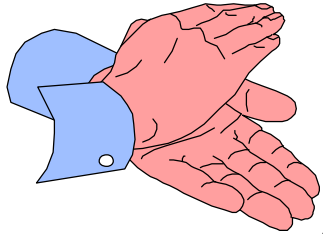
# Architectural Issues

- \* **Extended Enterprise .vs. Virtual Enterprise**
- **New Awareness Models for SMEs**
- **Towards Common Standards**
- **Several Challenges**
  - **Boundary Less Information Flow**
  - **Re-engineering The New Enterprise**
  - **Integrating the 5 Cs : Collaboration**
- **Decision Information Synchronization, Dynamic Systems**
- **Improved Concurrent Engineering Processes**
- **Phased Development Plans..Integration**
- **Supply Chain Management Issues**
- **Knowledge Management Issues**
- **etc.**



# Conclusions

- \* **Extended Enterprises: Growing**
- **Many SMEs Struggling for Standards, Roadmap etc**
- **Several Challenges**
  - **Boundary less Information Flow Issues**
  - **Re-engineering Towards The New Enterprise**
  - **Integrating the 5 Cs : Collaboration Focus**
    - **Trust, New HR Roles, Mindset Changes**
- **Decision Information Synchronization**
- **Improved Concurrent Engineering Processes**
- **Phased Development : Risk, Costs, Learning**
- **Supply Chain Management, KM, e-Business**
- **New Architectures Needs: Flexibility, Chain DIS, Integration, Collaboration, Dynamics.....**



# Acknowledgements

- Conference Organizers
- All Participants, Fellow Speakers
- The Open Group

Thanks To All