Collaborative Project Management and Intellectual Bandwidth: Knowledge Acquisition and Utilization for Long Term Success

Knowledge Sharing For Business Results

The 4th KM workshop on

Knowledge Management

in **Project Management**

Wednesday May 3rd, 2006

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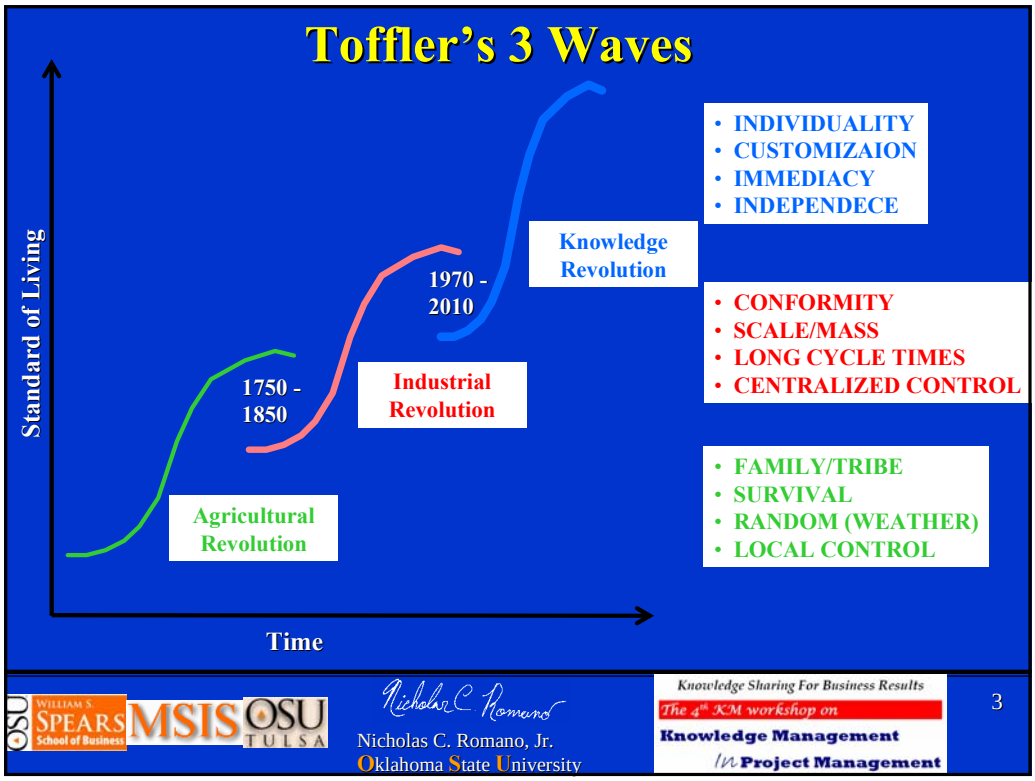
Talk Outline

Changing Nature of Project Management
Project Management & Knowledge Management
Intellectual Bandwidth (KM & Collaborative Systems)
"Collaborative" Project Management (CS & PM)
Importance of Consistent Process Across Projects
Intellectual Bandwidth Maturity (DM, CM, Process-M)
CPM Architecture for Long Term Success


Toffler's 3 Waves
Standard of Living
Time
1750 - 1850
1970 - 2010
Agricultural Revolution
Industrial Revolution
Knowledge Revolution
• INDIVIDUALITY
• CUSTOMIZAION
• IMMEDIACY
• INDEPENDECE
• CONFORMITY
• SCALE/MASS
• LONG CYCLE TIMES
• CENTRALIZED CONTROL
• FAMILY/TRIBE
• SURVIVAL
• RANDOM (WEATHER)
• LOCAL CONTROL
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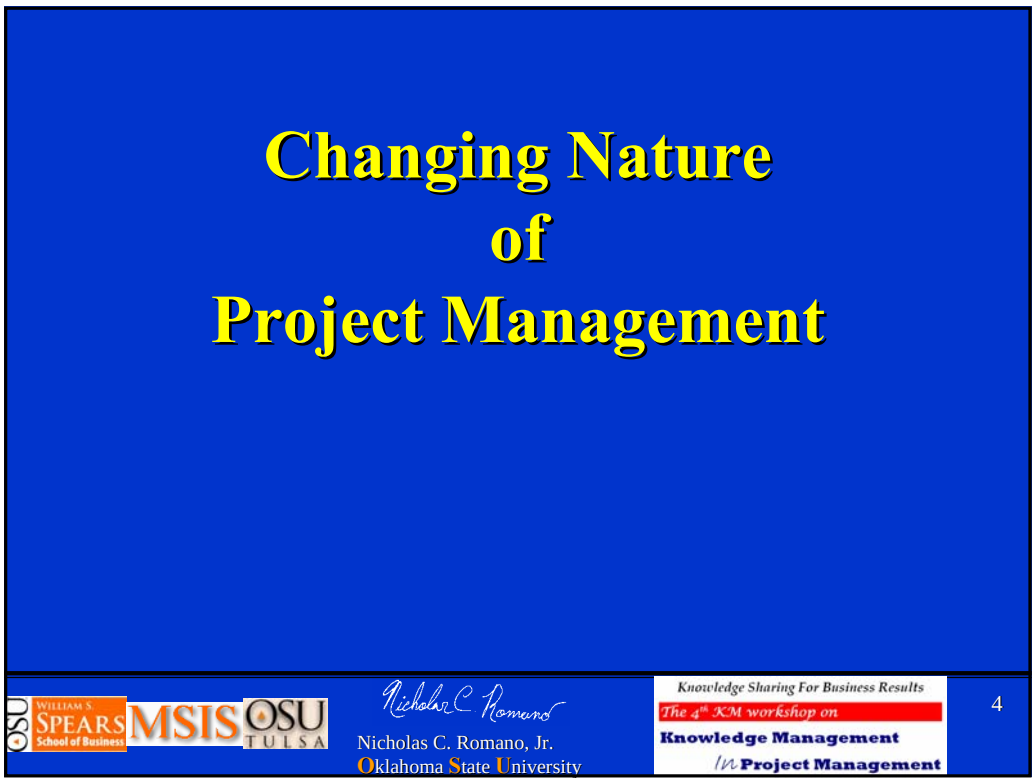
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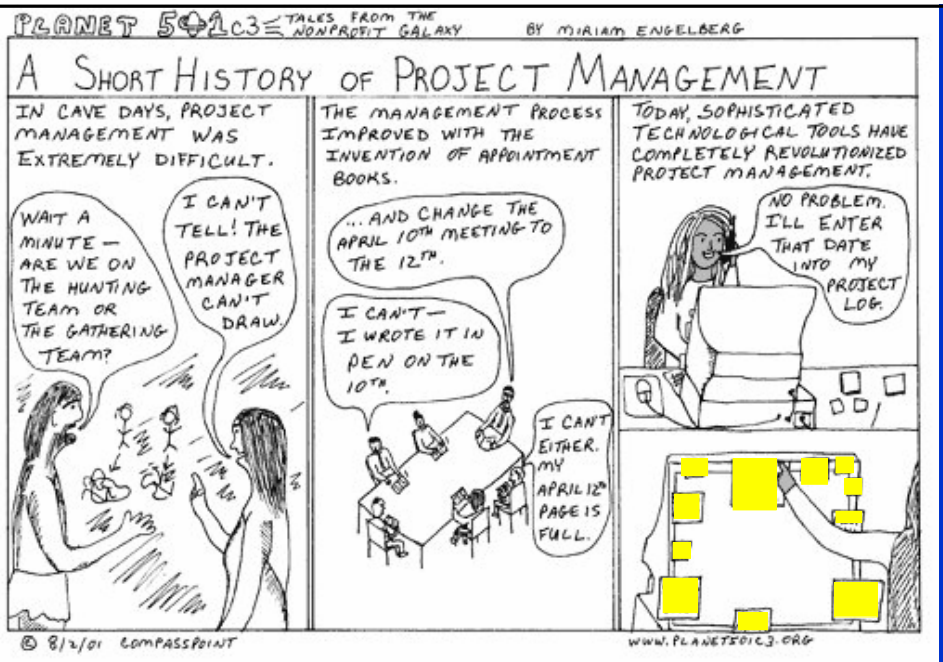
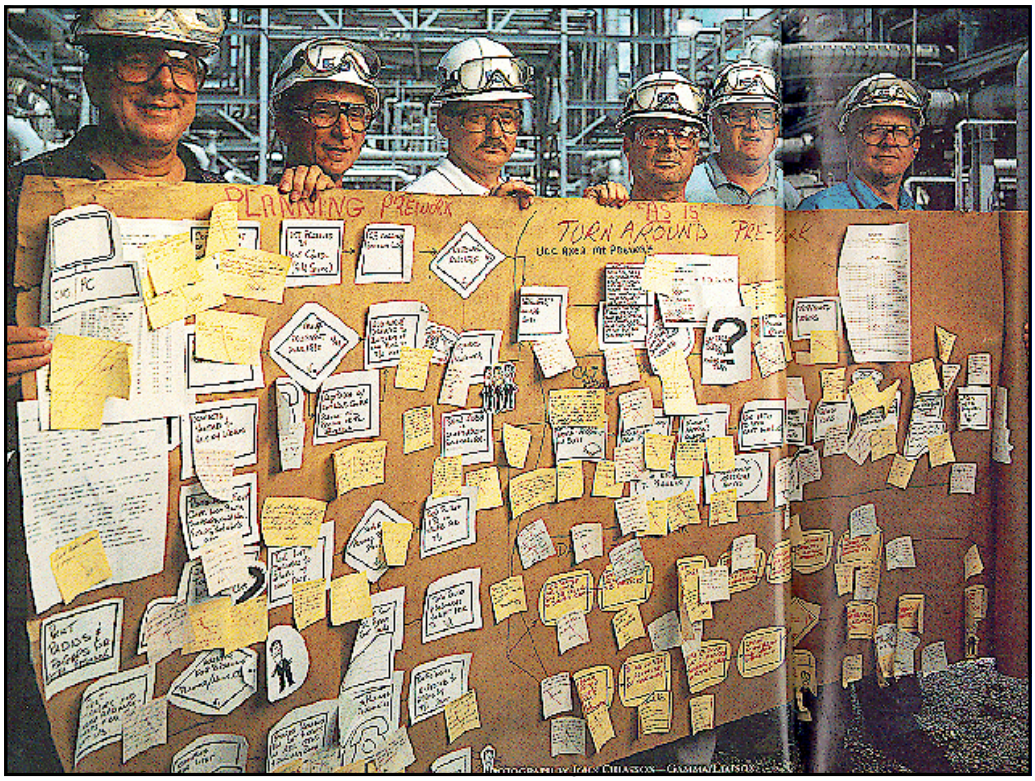
Changing Nature of Project Management

Have Projects Changed?
If so How?
or
Are projects still the same and new technology makes no difference?





*"Conventional face-to-face practices form an **essential part of successful project** co-working.*

*But this is **often impossible in globally-dispersed projects**.*

*New information and communication technology solutions are needed for converting collaborative actions into **virtual ones**."*

(Marttiin et al. 2002)

*"Most project management techniques were designed for **co-located teams**.*

*Those techniques may prove **ineffective in global, multi-site** organizations."*

(Nidiffer and Dolan 2005)

PM Challenges

Almost all project management teams experience many challenges:

- Effectively Applying **Best Practices Consistently**
- Planning/Executing **Repeatable, Customizable Processes**
- Communicating **Current Status** to All Team Members
- Accurately **Measuring Team Progress**

These are Exacerbated in Virtual Projects

Typical Project Management Challenges

- Intra- and inter-**team Dynamics**
- Financial, contract, and budget issues
- Insertion, migration, integration of **rapidly changing technologies**
- Keeping management informed of **progress/problems**
- Staffing, training, and retaining a team

These are Exacerbated in Virtual Projects

Typical Project Management Challenges

- Equipment and resource needs
- Competition from other teams, vendors, Partners
- Demand for **faster delivery cycles**/**higher quality**
- **Politics** between departments and teams
- Potentially **challenging customer relationships**

These are Exacerbated in Virtual Projects

Typical Project Management Scenario

Overemphasis of PM as a **Reporting Mechanism**

Ineffective Communication

Managing Project Inputs and Outputs **but not Process**

Reactive Management

Lack of an **Electronic Project Repository**

These are Exacerbated in Virtual Projects

Typical Project Management Scenario

Overemphasis of PM as a Project Reporting Mechanism

Outputs are captured – e.g. PERT chart and Gantt chart

Analyses of processes are NOT always captured –

Decision Rationale & Analysis involved in decision making

- Breaking down project into manageable tasks
- Estimating processing time for each task
- Organizing task order
- Identifying task interdependencies
- Estimating possible risks related to each task
- Selecting alternatives to mitigate the risks

Typical Project Management Scenario

Ineffective and Inefficient Communication

Misunderstandings due to **Inexplicit Communication**

Poor Grasp of Problem

Lack of shared vision

Hidden Agendas

Dominated by a few players

Explicit Project Knowledge not collected at
sufficient level of detail for distributed Teams

Failure to collect, represent, communicate
Tacit Project Knowledge

Typical Project Management Scenario

Managing Project Inputs and Outputs but not Process

Inputs – Budget, personnel, time etc.

Outputs – Products, reports etc.

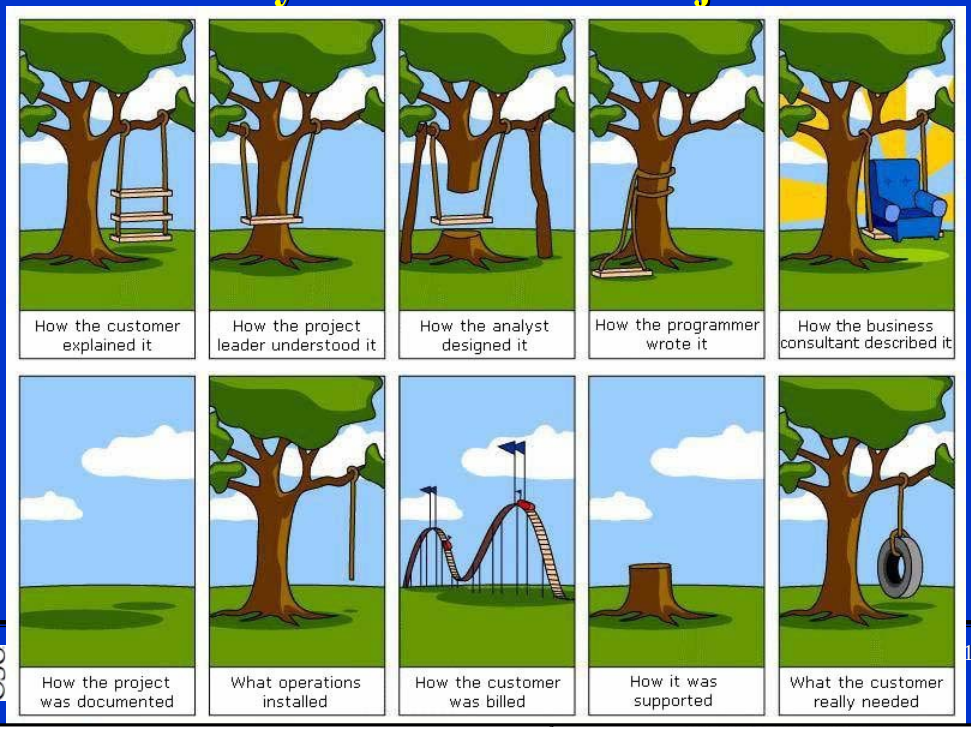
Failure to Address Process Management:
- Process remains a **black box**
- Inadequate process **visibility** results in:
  - Reactive management
  - Insufficient risk Analysis and management
  - **Inexplicit Communication**

Typical Project Management Scenario

Reactive Management

Poor Planning
Ignored Alternatives
Inaccurate Estimates
Failure to Focus attention
Systems are too passive
Procrastination

Lifecycle of a Failed Project



How many of you use an Electronic Repository for EVERY project?

What is NOT stored on the electronic repository?

Lack of an Electronic Project Repository

	Repository Type	
	Paper/Manual	**Electronic**
PM Activity	**Difficulties/Challenges**	**Solutions**
Locate	Search through paper stacks	Key word searches AI Categorization
Access	File Cabinet – Locked Office	Web-based 24/7
Share	Manually Distribute hard copies	Role-Based/Secure Online or Email
Archive	Store in workbooks in file cabinets	Archive via Database – versioning
Update	Re-enter data, reprint, distribute	Real-time – online/ email notification
Backup	Print Additional Copies	Tape/CD/HD

(Chen et al. 2003)

Emerging PM Challenges

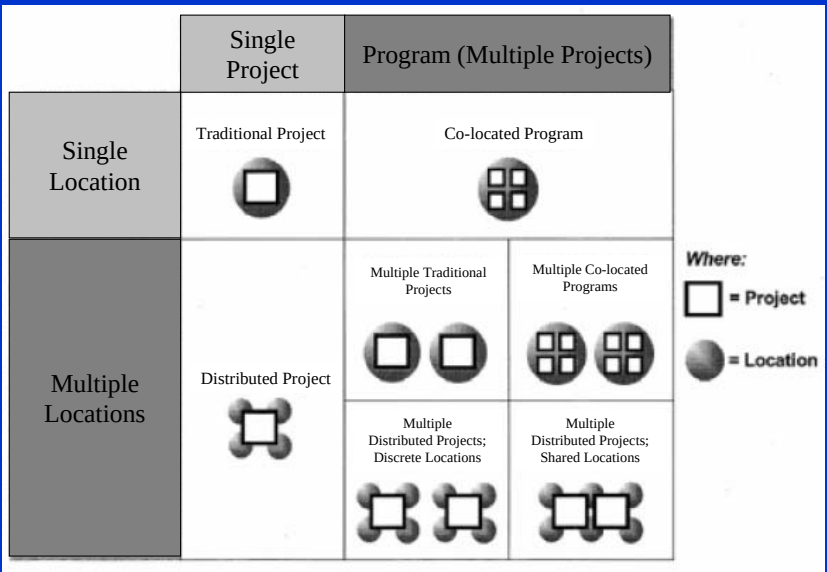
What do you see as the greatest challenges for project management In the near future?

How will you cope with them?

Emerging PM Challenges

- Projects and their complexities have changed
  - **Global – Cross-National/Multi National**
  - **Cross Organizational** (CPOCs and CPOCMA, Functionals, Automators, Fielders, DOIMs, DISA)
  - **Geographically Dispersed** (home, office, hotel, PDA, etc.)
  - **Multidisciplinary**
  - Time expectations have changed (Rapid Development and Fielding)
  - **Team Centered**
  - **Culturally Diverse** set of Players

Evaristo and Fenema's Project Classification Scheme



(Evaristo and Fenema 1999)

There has been a Steady Movement From a Work-*Place* >> To a Work-*Space*

Physical Location-Based Work-*Place*

1950's

Mainframes
Stand Alone DP
Telephone/Tie Lines/Teletype
Mail/Paper Memos
Typewriter/Carbon Paper
Copier
Calculator/Slide Rule

Distributed Digital-Based Work-*Space*

2006

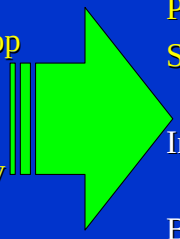
Personal Computers/PDAs
E-mail/Fax/Voice Mail/Pagers
Instant Messaging
Video Teleconferencing
Enterprise-wide Integrated Communication
LANs/WANs/Internet/Intranet
Discussions/Forums/News
Collaborative Systems

(Nunamaker et al. 1998)

PM Paradigm is Shifting

Traditional (Restrictive)

Management and Control Focus
Outcomes primary concern
Few maintain control from top
Decision makers at top
Information flows from top down and bottom up only
Limited view to own tasks
Information owned by top



Collaborative (Participatory)

Network focus
Process as important as outcomes
Shared decision-making and responsibility across team
Information flow in all directions as needed
Big picture view available
Information owned by team

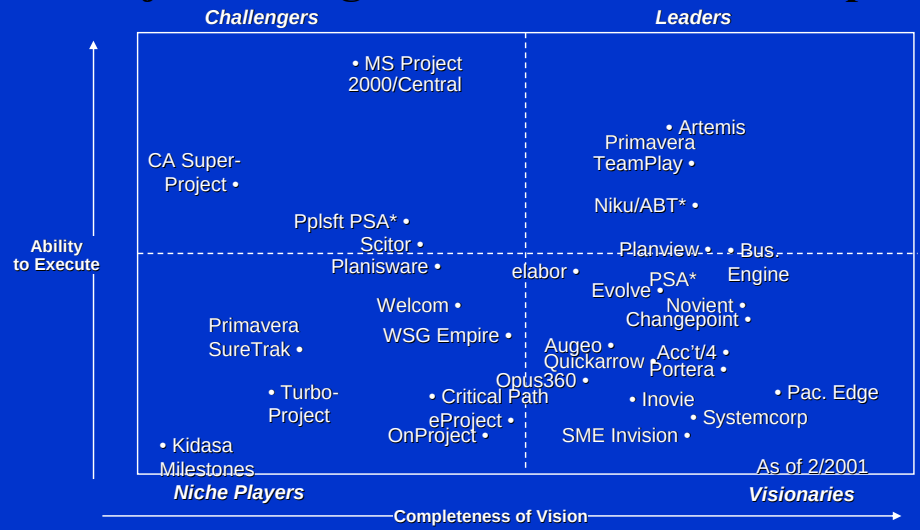
(Chen et al. 2006 forthcoming)

Project Management Tools

Which PM Tools do you Employ?

Do they work for you?

Project Management Software Landscape



Project Management & Knowledge Management

Project Management
&
Knowledge Management

What do they have in Common?
or
Are they just synonyms?

Project Management (PM) & Knowledge Management (KM)

Project

Temporary Effort To Create A Unique Product Or Service.

Project Management

Completion of Project **on Time**, under Budget, within Scope and Meeting Stakeholders' Expectations.

Major Focus

- Planning
- Control

Knowledge

Insights Derived from Information Usually **Reflected Through Action**.

Knowledge Management

Purposeful Effort to Develop And Apply Knowledge to Improve Performance.

Major Focus

- Systems Thinking
- Organizational Development

PM and KM are both

- Practical
- **Action-oriented**
- Not dependent on technology
- **In need of top management support**
- Associated with change management
- **Not new!**

PM is

Based on theoretical & practical knowledge

Influences the organization structure

KM is

Based on concept of learning

Independent of the organization structure

What else is common between PM and KM?

Project management is a discipline that also involves:

- Teams working together
- Learning from each other
- Sharing data, information and knowledge
- Integrating all project activities

…Data, information, and knowledge related to all aspects of project are acquired, organized, and assembled to present a ***coherent picture of project status****, that is what project integration is all about….* ***Project integration management harnesses the tool of knowledge management to pursue unity of effort.***

-Denis F. Cioffi, *Managing Project Integration*, 2002

Knowledge Management "Systems"

Organizational Knowledge

- Organizational knowledge consists of the **critical intellectual assets** within organizations
- Isolated facts are **not** organizational knowledge
- To be classified as "knowledge" information must be ***integrated with experience, context, interpretation, and reflection***

(Davenport et al. 1998)

Types of organizational knowledge Located within Different People

Cost of poor knowledge harnessing and use

How much does it cost knowledge workers to search for information?

In a single day how much money is spent searching?

Cost of poor knowledge harnessing and use

- How much time/money do knowledge workers spend searching for information/Knowledge?

Conservative Estimate

Typical employee spends at least
15-30 min. per day searching for information

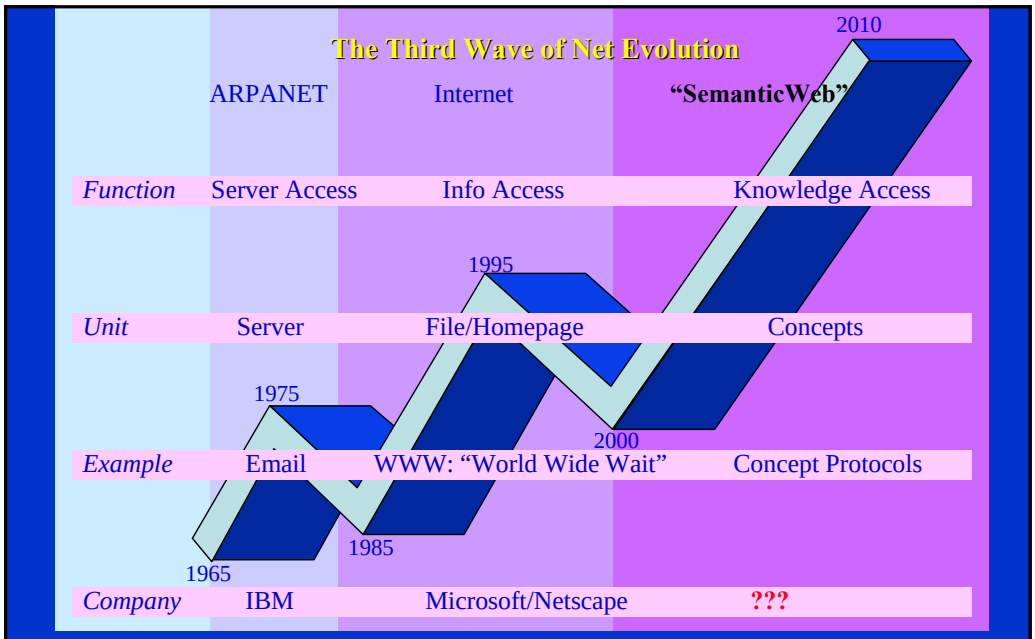
Based on annual hours of 2,080, the fully burdened hourly rate for a $50K salaried employee is approximately **$40**

In this case the cost of searching for information is
$10-20 per employee, per day

Cost of Poor Knowledge Harnessing and Use

- **Another Estimate:**
  - Poor knowledge harnessing costs U.S. businesses an estimated **$1.4 trillion***
    - Failure to capture knowledge gained or used results in **rework**, researching for, and possibly **redundant** development of knowledge
    - Valuable knowledge gained on projects **walks out the door** at the end of the day when workers go home – or worse – to a new job at the competition

**Fast Company*, December 2004



(Chen, H. 2005)

Knowledge Management Definition

"The system and managerial approach to collecting, processing, and organizing enterprise-specific knowledge assets for business functions and decision making."

(Chen, H. 2005)

Knowledge Management Challenges

- "… making high-value corporate information and knowledge easily available to support decision making at the lowest, broadest possible levels …"
  - Personnel **Turn-over**
  - Organizational **Resistance**
  - **Manual Top-down** Knowledge Creation
  - Information **Overload**
  - Poor Usability of existing software

(Chen, H. 2005)

Knowledge Management Landscape

- **Research Community**
  - NSF / DARPA / NASA, Digital Library Initiative I & II, NSDL ($120M)
  - NSF, Digital Government Initiative ($60M)
  - NSF, Knowledge Networking Initiative ($50M)
  - NSF, Information Technology Research ($300M)
- **Business Community**
  - Intellectual Capital, Corporate Memory,
  - Knowledge Chain, Competitive Intelligence

(Chen, H. 2005)

Knowledge Management Foundations

- **Enabling Technologies**:
  - Information **Retrieval** (Excalibur, Verity, Oracle Context)
  - Electronic **Document Management** (Documentum, PC DOCS)
  - Internet/Intranet (Yahoo!, Excite)
  - **Groupware** (Lotus Notes, MS Exchange, GroupSystems)
- **Consulting and System Integration:**
  - Best practices, human resources, organizational development, performance metrics, methodology, framework, ontology (Delphi, E&Y, Arthur Andersen, AMS, KPMG, etc…)

(Chen, H. 2005)

Knowledge Management Perspectives:

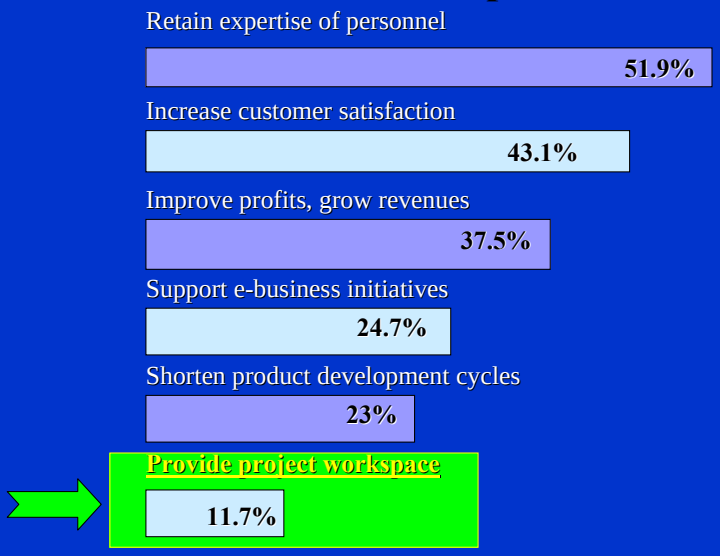
- Process Perspective (management and behavior): consulting practices, methodology, best practices, e-learning, culture/reward, existing IT
  ➔ new information, old IT, new but manual process
- Information Perspective (information and library sciences): content management, manual ontologies (categories)
  ➔ new information, manual process
- Knowledge Computing Perspective (text mining, artificial intelligence): automated knowledge extraction, thesauri, knowledge maps
  ➔ new IT, new knowledge, automated process

(Chen, H. 2005)

Knowledge Management Systems

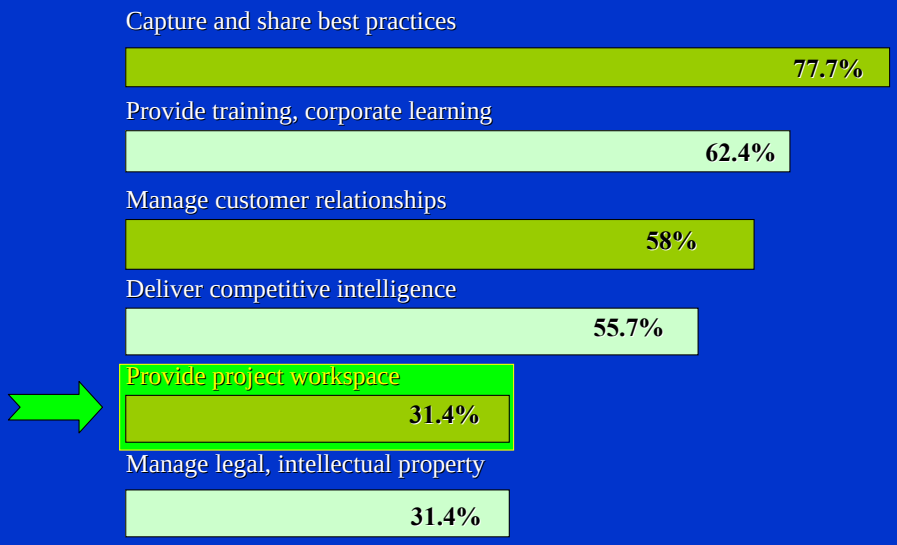
How are they deployed In terms of Project Management?

Reason firms Adopt KM



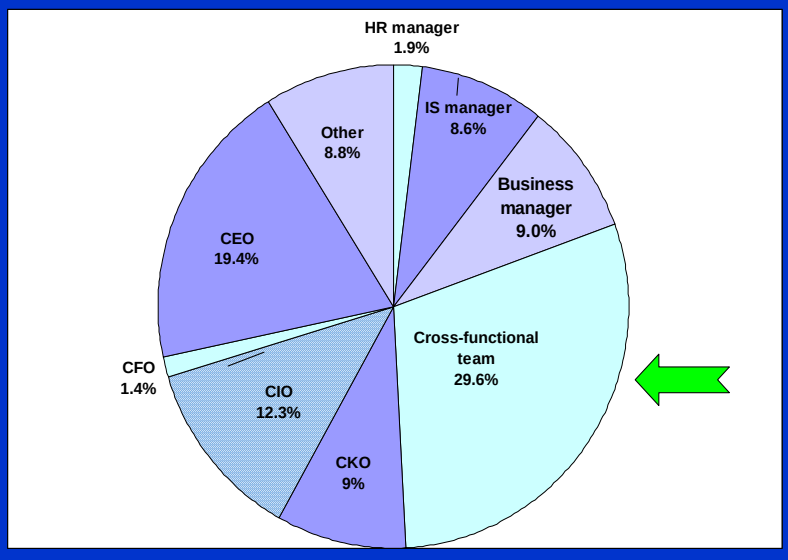
(Source Knowledge Management and IDC May 2001)

Business Uses Of KM Initiative



(Source Knowledge Management and IDC May 2001)

KM Initiative Leader



(Source Knowledge Management and IDC May 2001)

KM Implementation Challenges

Employees have no time for KM

41%

Current culture does not encourage sharing

36.6%

Lack of understanding of KM and Benefits

29.5%

Inability to measure financial benefits of KM

24.5%

Lack of Skill in KM techniques

22.7%

Organization's processes are not designed for KM

22.2%

Continued

KM Implementation Challenges

Lack of funding for KM

21.8%

Lack of incentives, rewards to share

19.9%

Have not yet begun implementing KM

18.7%

Lack of appropriate technology

17.4%

Lack of commitment from senior management

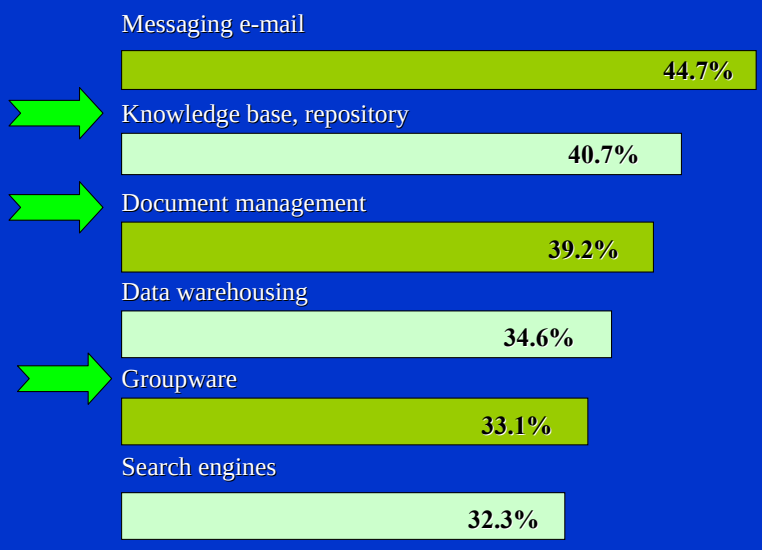
13.9%

No challenges encountered

4.3%

(Source Knowledge Management and IDC May 2001)

Types of Software Purchased



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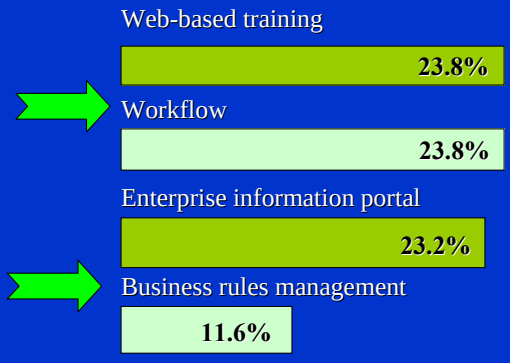
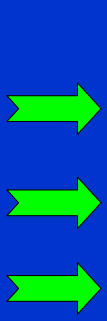
Types of Software Purchased



(Source Knowledge Management and IDC May 2001)

Software Budget Allotments



Enterprise Information Portal

35.6%

Document Management

26.2%

Groupware

24.4%

Workflow

22.9%

Data Warehousing

19.3%

Search Engines

13.0%

Continued

Software Budget Allotments

Web-based training

11.4%

Messaging e-mail

10.8%

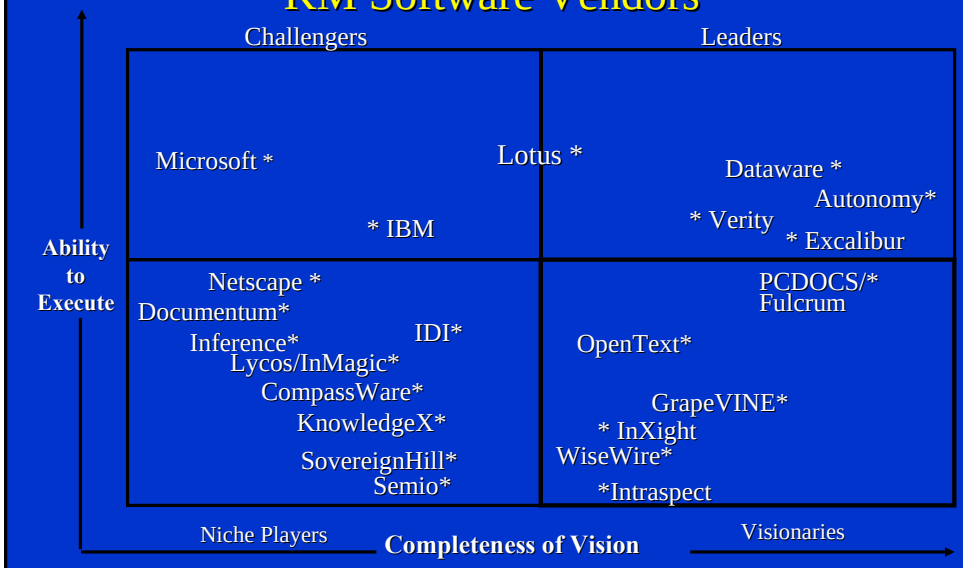
Other

29.2%

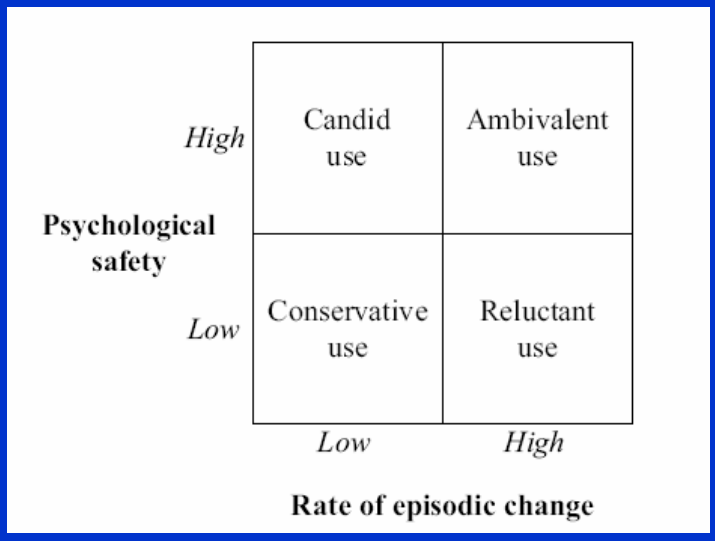
(Source Knowledge Management and IDC May 2001)

What KM Tools do you use for PM?

KM Software Vendors



Typology of KM Systems Use by Teams



(Bernard, J. 2006)

Knowledge Management
A Hierarchical Perspective

Data, Information, Knowledge, Wisdom and understanding can be organized into a hierarchy

To offer some insights about how we might employ IT to manage knowledge

Knowledge Management A Hierarchical Perspective

Ackoff describes these concepts as **contents of learning** and suggests that they form a hierarchy of increasing value.

Ackoff presents the following adage to reflect the idea of a hierarchy of increasing value:

"An ounce of information is worth a pound of data; an ounce of knowledge is worth a pound of information; an ounce of understanding is worth a pound of knowledge; and an ounce of wisdom is worth a pound of understanding."

(Ackoff 1989)

Unit of Analysis Has Changed

- **Data**: 1980s
  - Factual
  - Structured, numeric → Oracle, Sybase, DB2
- **Information**: 1990s
  - Factual
  - Unstructured, textual → Yahoo!, Excalibur, Verity, Documentum
- **Knowledge**: 2000s
  - Inferential, sensemaking, decision making
  - Multimedia → ???

(Chen, H. 2005)

Knowledge Management A Hierarchical Perspective

KM researchers distinguish between the concepts of data, information and knowledge:

Data: Facts, Images, or sounds
(+ interpretation + meaning =)
Information: Formatted, filtered, summarized data
(+action + application=)
Knowledge: Instincts, ideas, rules, and procedures that guide actions and decisions.

(Ackoff 1989; Alter 1977; Beckman 1997; va der Spek and Spijkervet 1997)

Knowledge Management A Hierarchical Perspective

To this Tobin adds Wisdom:

Data: *(+relevance + purpose=)*
Information: *(+application=)*
Knowledge: *(+ intuition + experience=)*
Wisdom

(Tobin 1998)

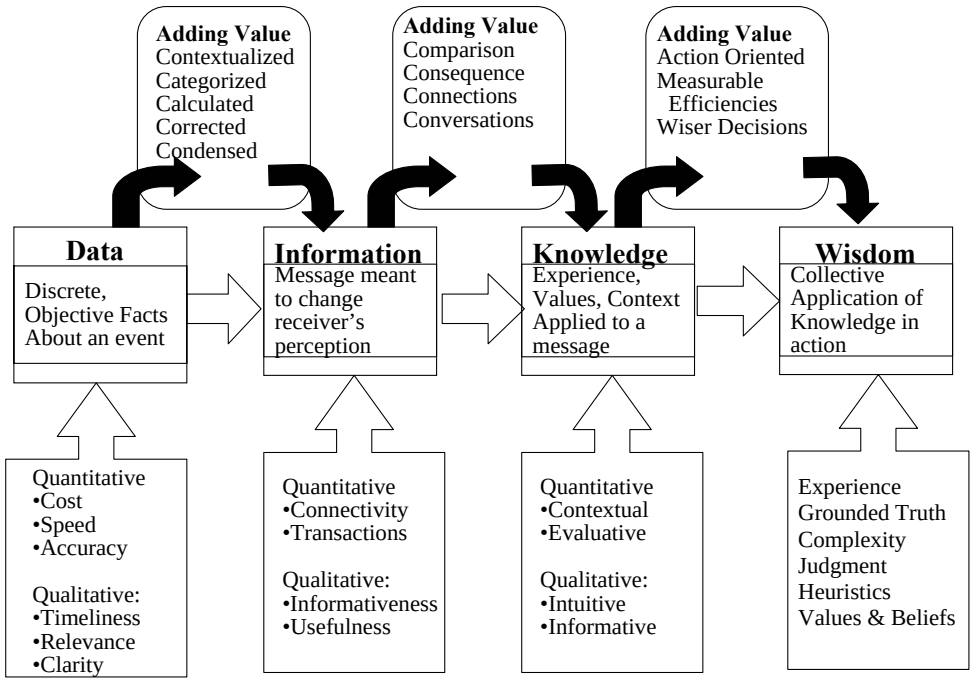
Knowledge Management A Hierarchical Perspective

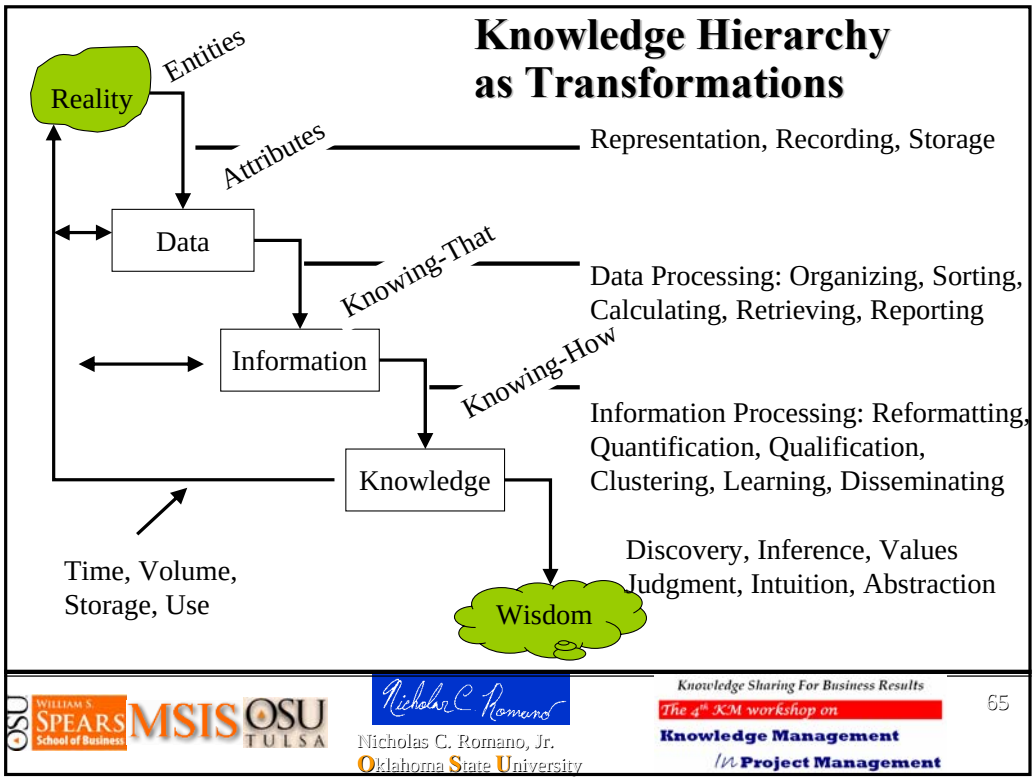
To this Ackoff adds understanding

Data:
Information:
Knowledge:
Understanding:
Wisdom:

(Ackoff 1989)

Sena and Shani's (1999) Knowledge Progression





Hierarchy of Understanding

We extend Tobin's Hierarchy

Understanding:

Supports Transitions and **Distinctions** between the other four levels

Refers to grasping of the **nature**, **significance**, or **explanation** of the levels in the hierarchy in terms of three concepts:

Awareness and Discernment
Context
Noise Detection

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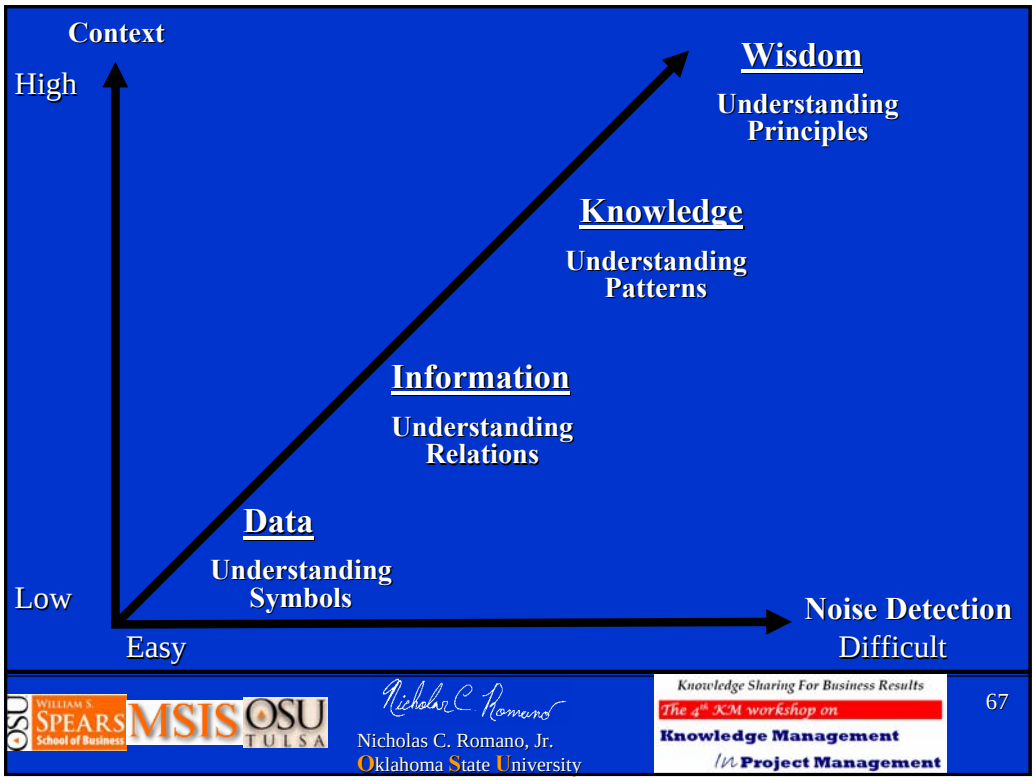
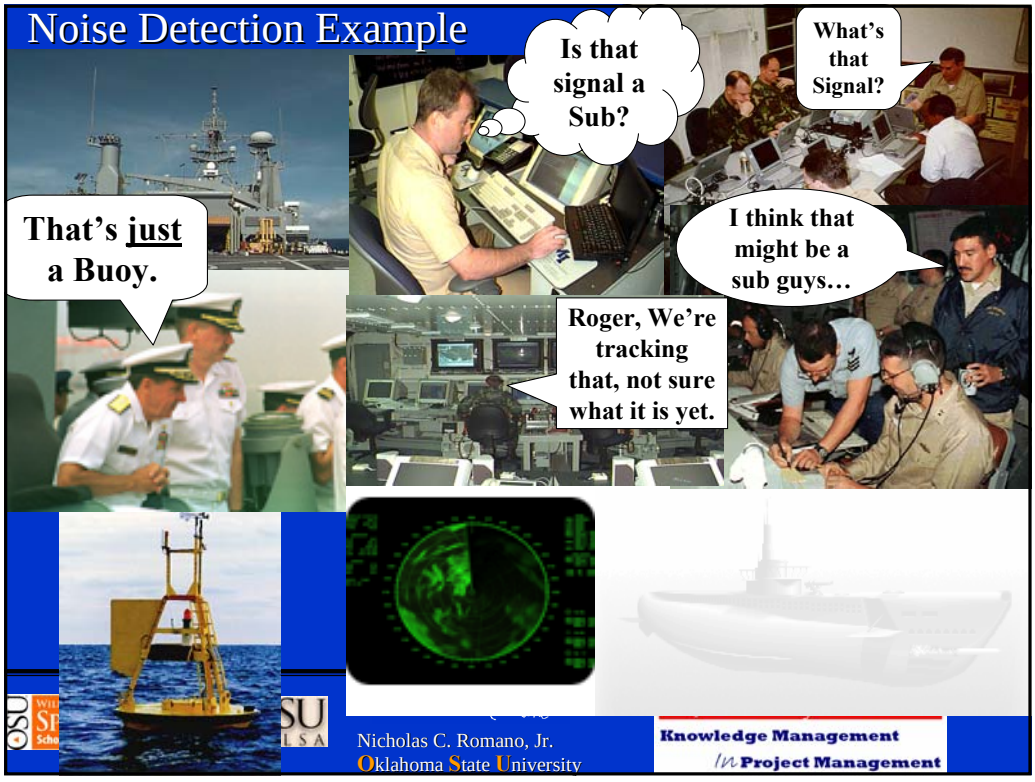

Context
High
Low
Easy
Noise Detection
Difficult
Wisdom
Understanding Principles
Knowledge
Understanding Patterns
Information
Understanding Relations
Data
Understanding Symbols


Noise Detection Example
That's just a Buoy.
Is that signal a Sub?
What's that Signal?
I think that might be a sub guys…
Roger, We're tracking that, not sure what it is yet.

Collaboration

Modes of Collaboration

Time \ Place	Same	Different
Same		
Different		

(Johansen 1998)

Systems to Support different Collaboration Modes

Time \ Place	Same	Different
Same	**Sessions** **Group Support**	**Audio/Video** **Group Support**
Different	**Team Rooms** **Project Rooms**	**Team Database** **Virtual Sessions**

(Johansen 1998)

Collaboration Behavioral Difficulties

What are some of the
Behavioral Difficulties
with Collaboration
You have experienced in projects?

Collaboration Behavioral Difficulties

Collaboration is Expensive

- 15 Million formal Sessions / day
- ? Million Informal Sessions / day
- 4 Billion Sessions / year
- 30-80% Manager's time

Fortune 500 Companies
3M Corporation Study

Collaboration is Essential

No one has all the

- Resources
- Experience
- Knowledge

To do the Job Alone

Collaboration is:

- **Difficult**
- **Expensive**
- **Essential**

Collaboration Is also defined Differently by different People and Groups

I Think that some of you may be having trouble with the company's concept of "**Groupware**."

When do you think the Term "Groupware" was Coined?

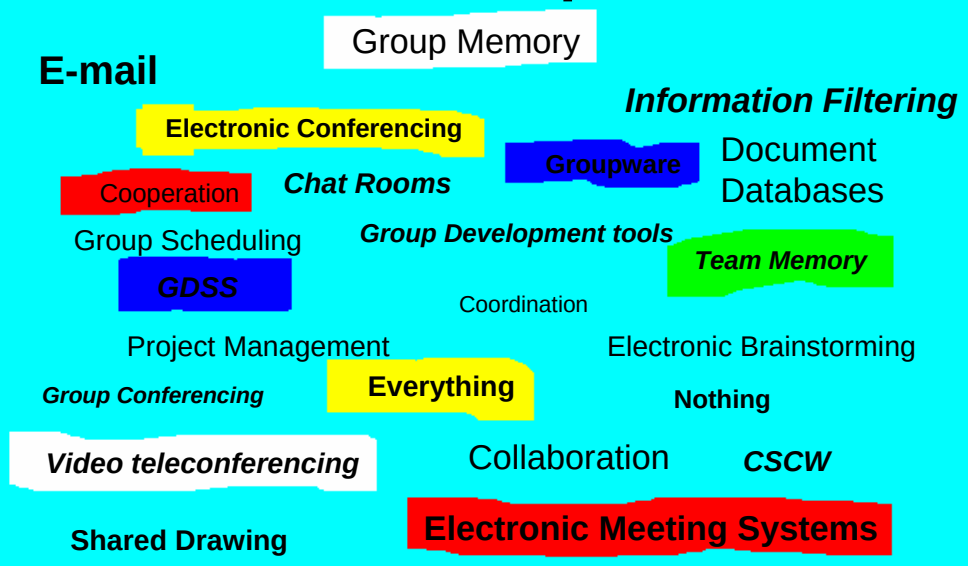
When do you think the Term "Groupware" was Coined?

"Groupware" first used by Peter and Trudy Johnson-Lenz.
They first used it in some unpublished works around ***1978-1980*** *and first used it in print in the early 1980s.*

Johnson-Lenz, P. and T. Johnson-Lenz, *Groupware: The emerging art of orchestrating collective intelligence*, in *First Global Conference on the Future*. 1980:Toronto, Canada.

Johnson-Lenz, P. and Johnson-Lenz, T. (1982). 'Groupware: the process and impacts of design choices', in Kerr and Hiltz (eds.), Computer-Mediated Communication Systems, Academic Press.

What is Groupware?



How do you define "Groupware"??

Groupware Definition and Focus I

- "intentional group processes plus software to support them" Peter and Trudy Johnson-Lenz 1978.
- "Groupware a generic term for specialized computer aids that are designed for the use of collaborative work groups" Johansen 1988.
- "computer-based systems that support groups of people engaged in a common task (or goal) and that provide an interface to a shared environment" Ellis 1989.
- "Software that supports and augments group work" Greenberg 1991.

Groupware Definition and Focus II

- From Human-to-Computer to **Human-to-Human** Interaction
- Key Elements:
  - Communication
  - Collaboration
  - Coordination

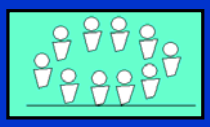
4 Levels of Collaboration Capability

Low

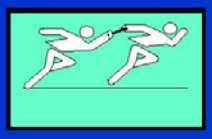
Degree of Collaborative Value Generated Through Synergy

High

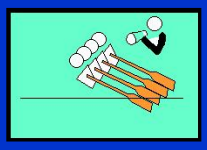
Level 1 Collective Effort:
Uncoordinated Individual Efforts



Level 2 Communicative Effort:
Conversational Efforts

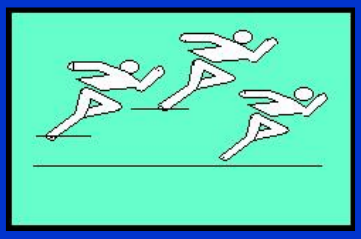


Level 3 Coordinated Effort:
Coordinated Individual Efforts



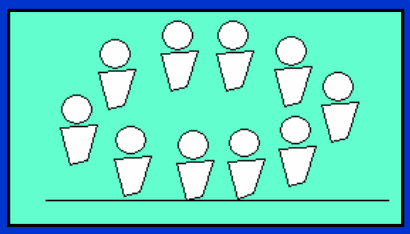
Level 4 Concerted Effort:
Concerted Team Effort

Level 1 Collective Effort



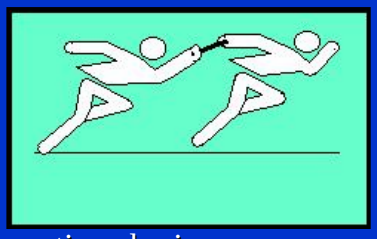
- Individual, uncoordinated effort toward team goal
- Team productivity (Simple Sum of Individual Performances)
- Individualized Processes - Start to Finish
- Office Applications
  - MSWord Group Editing
  - Multiple Spreadsheet Sections
  - Powerpoint Presentation Passing

Level 2 Communicative Effort



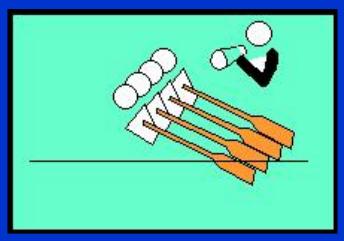
- Everyone can communicate with everyone
- Email enables communication
- Discussion boards and forums are examples
- Little or no structure

Level 3 Coordinated Effort



- Unstructured information sharing
- Ad hoc Process & Coordinated Efforts and Processes
- Information Sharing & Coordination Applications
  - Lotus NOTES Discussions
  - Net Meeting
  - Video Teleconferencing
  - Application Sharing (Proshare)
  - Chat, News Groups
  - Workflow Applications
    - Adding structure to NOTES
    - Coordinator

Level 4 Concerted Effort



- All team members work a process simultaneously to achieve the team goal
- Repeatable Customized Process
- Attention Dynamics
- Collaborative Applications
  - GroupSystems Online
  - Facilitate.COM
  - Meetingworks

Level 4 Concerted Collaboration

- Two to Hundreds of people
- Complex issues Addressed
- Everyone
  - Contributes Equally
  - Perceives everything Multiple Perspectives
  - Focuses Attention on Critical Issues
  - Takes ownership of the solution
- All Knowledge at everyone's fingertips
- Design Customized Repeatable Processes
- Accomplish Goals and Produce Products

Intellectual Bandwidth

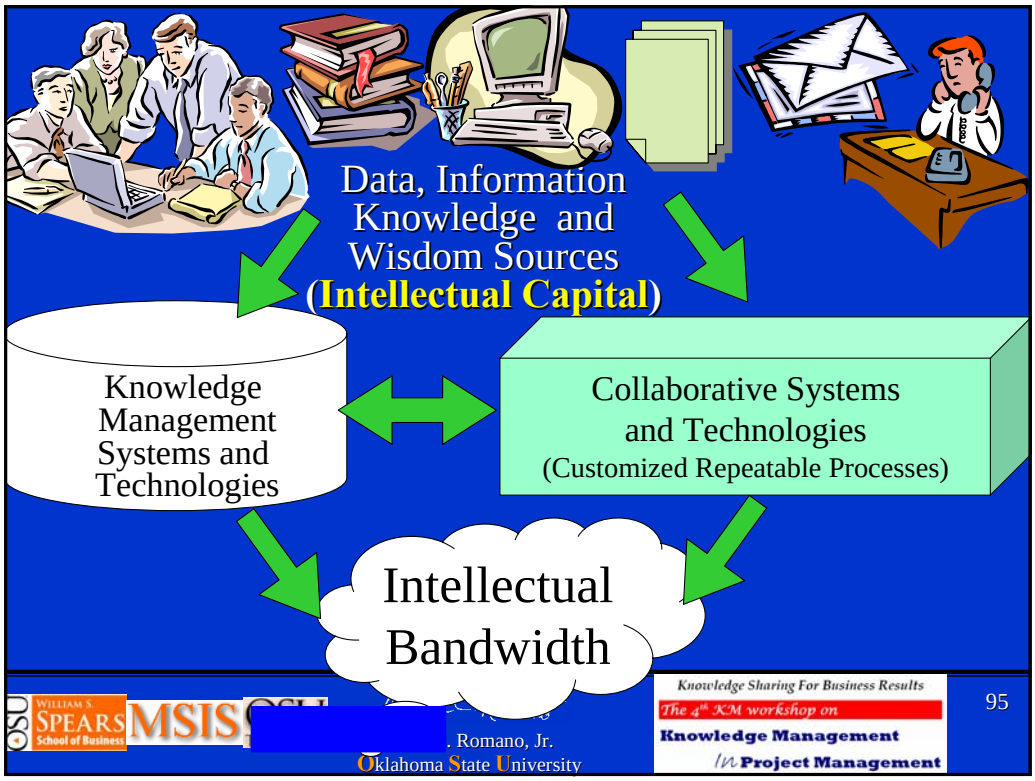
Intellectual Bandwidth
(Knowledge Management and Collaborative Systems)

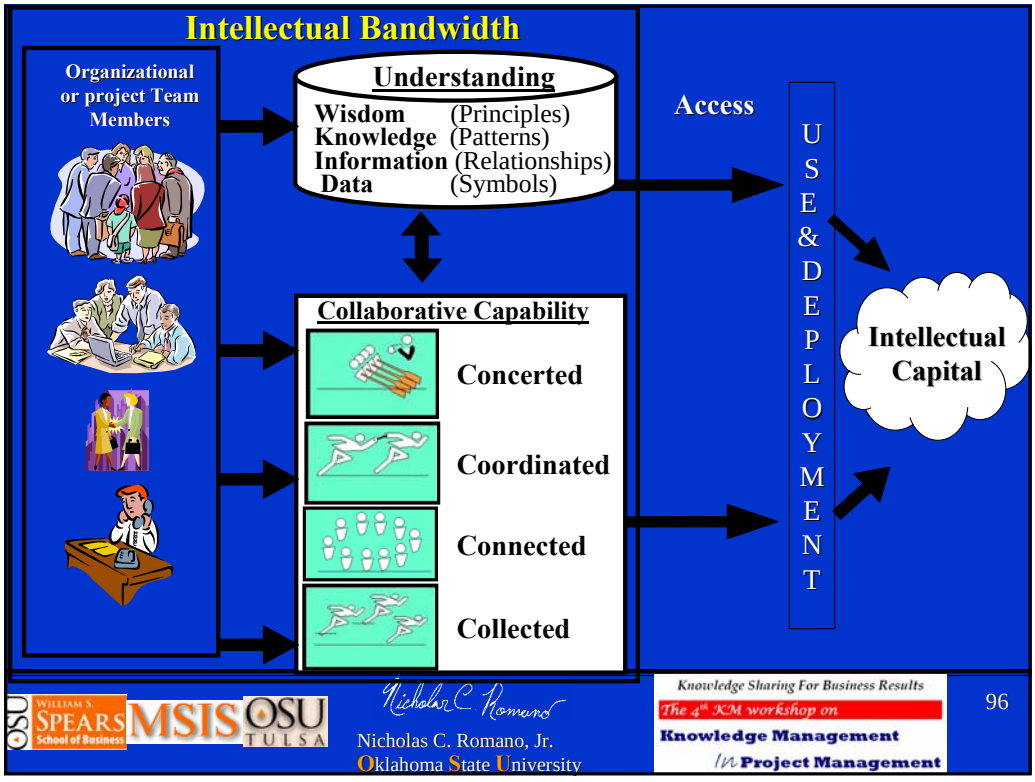
Intellectual Bandwidth (IB)

"**Organizational or project Team ability** to bring Intellectual Capital **to bear** when addressing a particular issue."

Intellectual Bandwidth (IB)

A function of success with which an organization or project team **deploys and uses** Knowledge Management and Collaborative Technology


Data, Information
Knowledge and
Wisdom Sources
(Intellectual Capital)
Knowledge
Management
Systems and
Technologies
Collaborative Systems
and Technologies
(Customized Repeatable Processes)
Intellectual
Bandwidth
MSIS
. Romano, Jr.
Oklahoma State University
Knowledge Sharing For Business Results
The 4th KM workshop on
Knowledge Management
in Project Management
95


Intellectual Bandwidth
Organizational
or project Team
Members
Understanding
Wisdom (Principles)
Knowledge (Patterns)
Information (Relationships)
Data (Symbols)
Collaborative Capability
Concerted
Coordinated
Connected
Collected
Access
USE&DEPLOYMENT
Intellectual
Capital
MSIS
Nicholas C. Romano, Jr.
Oklahoma State University
Knowledge Sharing For Business Results
The 4th KM workshop on
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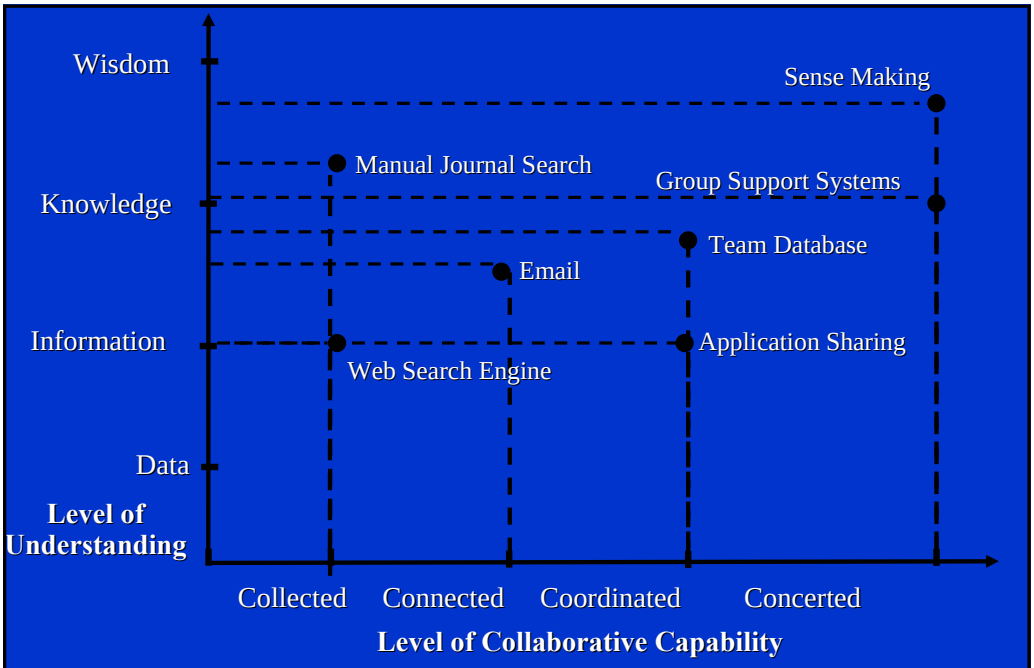
in Project Management
96

Collaboration
&
Knowledge Management
Increase and Leverage
Intellectual Bandwidth



"Collaborative" Project Management

Why Collaborate?

"Collaborative working practices have become crucial to the sustained success of virtually every type of organisation"
Ark Group Survey, 2005

2004 Ark Group Survey

64% organisations had secured board-level support for collaborative activities ……..

only 25% had actually started to implement a collaboration initiative

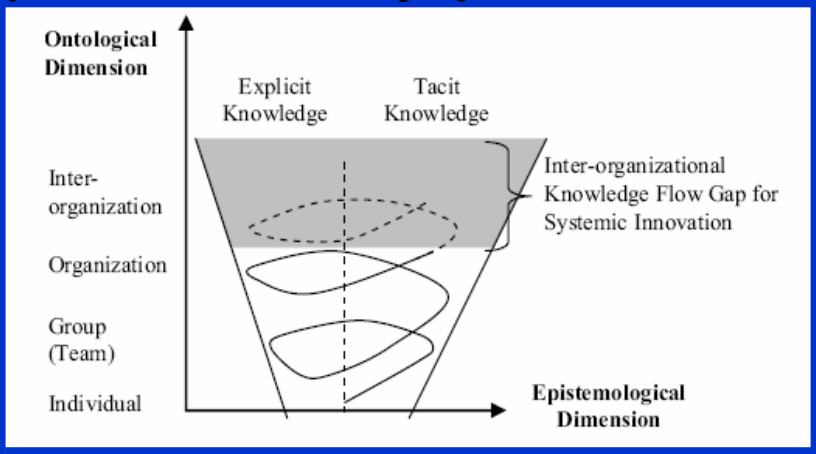
Benefits of Collaborative Project Management

- **Customer and Results Focus**
  - Improves customer satisfaction by improving coordination and reporting on key milestones
  - Enhances service and support activities with better communication among all project participants
- **Internal Projects**
  - Structured project collaboration produces higher quality results
  - Integrated toolset improves productivity and fosters better use of resources

Collaboration Happens at Different Levels within and outside organizations

- **Community level**
  - Relatively intense interactions
  - Rheingold - “enough people carry on public discussions long enough, with sufficient human feeling, to form webs of personal relationships in cyberspace."
- **Network Level**
  - Interaction based around a topic or subject
- **Team Level**
  - Based around a project, task, process

Inter-organizational knowledge flow for systemic innovations in project-based industries



(Taylor and Levitt 2005)

Collaborative Applications will benefit Individual projects:

1. By shortening project completion times
2. By reducing errors due to poor coordination
3. By increasing accountability (and reducing legal costs)

"Collaborative" Project Management

What Collaborative tools do you use for project management?

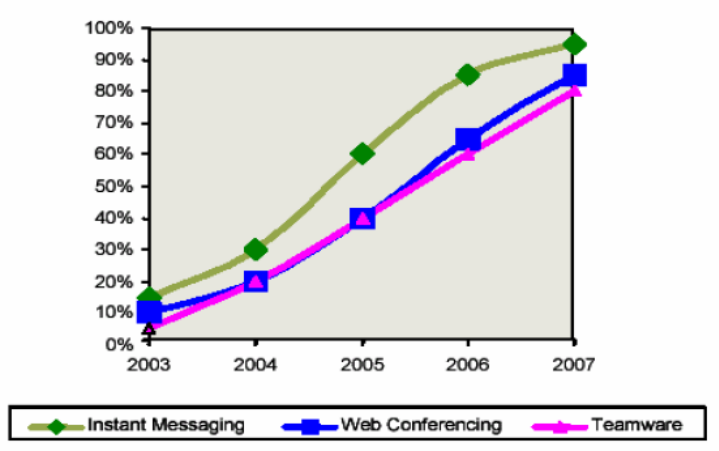
Which ones are useful?

Technologies & Online Collaboration

- Discussion forums
- Email
- Instant messaging
- Newsgroups
- Webcasts
- Web conferencing
- Weblogs
- Team rooms
- Instant messaging
- Text messaging/wireless
- Really Simple Syndication (RSS)
- Wiki
- Expertise location
- Friend of a Friend (FOAF)

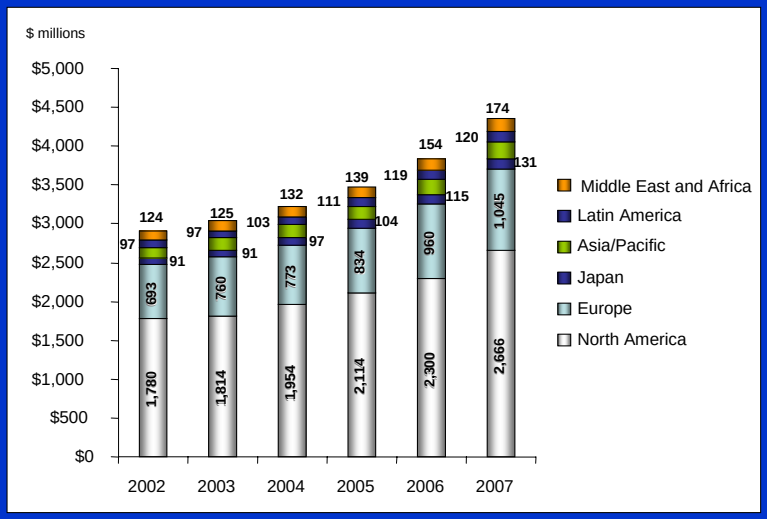
Market Penetration of Collaboration Tools by 2007

% of G2000 Knowledge workers with collaborative tools



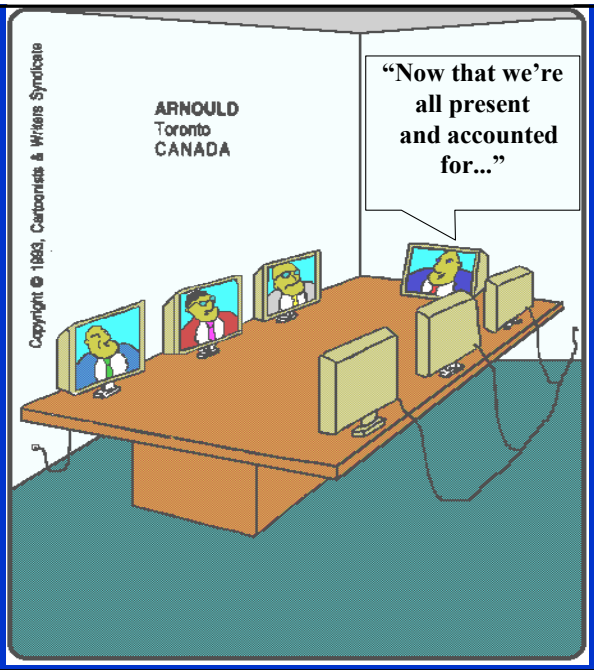
Source: Gartner 2003, "Collaborative Software and Knowledge Management Tools Market, 2002-2007".

Worldwide New License Revenue (Millions) Forecast for Collaboration Software and Tools by Region



Source: Gartner 2003, "Collaborative Software and Knowledge Management Tools Market, 2002-2007".

What is a Virtual Meeting or Project?

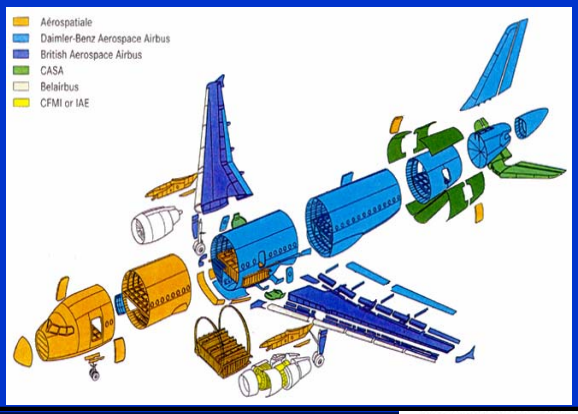


Collaboration among multi-stakeholders across virtual space is the key characteristics of virtual projects

Definition of Virtual Project

Virtual Project is a in project which project members are working in a distributed mode and relying heavily on advanced IT and telephony technologies for coordination of daily operations (Katzy et al. 1999; Zigurs et al. 2001)

Typical Example:

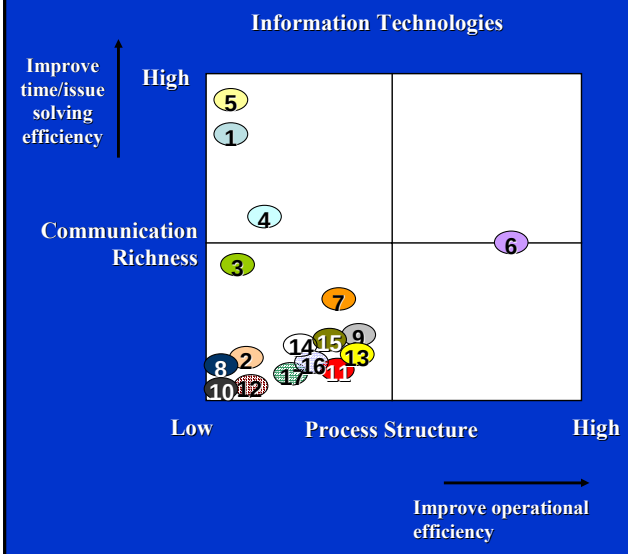


Typical life cycle of virtual projects consist of four phases

Key Life Cycle Phases	Key Processes	Supporting Tools
Initiation	• Acquisition • Customer requirement • Network Information exchange / Feasibility Check • Partner selection	• Customer contact / information database • Central document repository • Dedicated customer web-links web page • Public information web page • Audio / video/ data conf. E-mail / fax / telephone
Configuration	• Task creation • Task break down • Task allocation • Contract and negotiation	• Group workspace • Working templates • Partner contact/information/competence database • Audio / video/ data conf. E-mail / fax / telephone
Operation	• Project planning • Project status tracking • Project reporting • Conflict Management and task re-allocation	• Group calendar /Group Voting • Project planning Status tracking • Working templates • Group workspace • Audio / video/ data conf. E-mail/fax/ telephone
Completion	• Documentation/knowledge management	• Archive database

(Katzy et al. 2004)

Most collaboration tool functionalities are non-process structured



(Katzy et al. 2004)

1. Telephone/Audio conferencing
2. E-mail
3. Instant messaging/chat
4. Data and application sharing
5. Video conferencing
6. EDM / PDM / Supply chain tool
7. Voting system
8. Generating reports
9. Group Calendar
10. File sharing / management
11. Tracker (milestone)
12. Contact list
13. Version control
14. New event e-mail notification
15. Project planning
16. Tasks reminder
17. News group

Most tool vendors offer ONLY basic functionalities needed for virtual projects

1. Generating reports
2. File sharing / Management
3. Version Control
4. Contact list
5. Tracker (milestone)
6. Discussion Forum/group
7. Group Calendar
8. Voting system
9. e-mail
10. Multiple Languages Interface
11. Time card system
12. Bookmark
13. Todo list
14. Tasks Reminder
15. Search system
16. Ability for integration to other system
17. Personalised profile
18. Survey and feedback
19. Access level based on role
20. Access Control/Security
21. New events e-mail notification
22. Project planning
23. Create and manage announcements
24. Post team announcements
25. News Group
26. Web Conferencing
27. Instant messaging /chat
28. Audio conferencing

Functionality	Tools																												
	MainsGate	Flypaper Enterprise	TeamSpace (Flypaper)	eRoom Collaboration	Webplan 7	GROOVE WORKSPACE	PHProjekt	TWIG	phpBB	TUTOS	Teamware Pl@z@® 3.5	Teamware Office™	Team Crossing 3.0	VCOM 1.5	Flash Com Server MX	IBM LOTUS Workplace	IBM LOTUS Team	CeTIM CMS	Zano 2.0	Webcorp	Microsoft SharePoint	IBM Lotus QuickPlace 3.0	Web Crossing 4.1	SiteScape Enterprise Forum 7	eProject	onProject	ePeople	BSCW 4.1
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7	√	√	√	√		√	√			√		√					√	√		√		√	√	√	√		√
8		√		√			√			√			√								√				√		√	
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(Katzy et al. 2004)

Challenge: capitalise on potential value offered by next generation Internet

	Virtual Project Office	Collaborative Systems	Web-based supply chain management	Virtual Reality	Mobile data in AEC
Lead-time reduction	●	●	●	◗	●
Cost reduction	●	◗	◗	○	●
Quality improvement	◗	●	◗	◗	◗
Increase revenue	○	◗	○	●	○

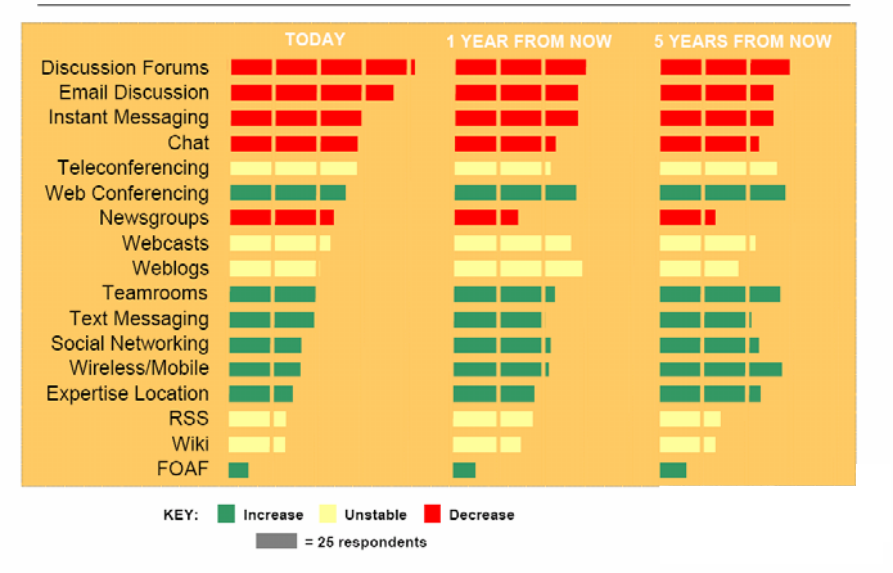
○ low ◗ medium ● high

Enterprise Collaboration Study

- Ambrozek and Cothrel surveyed a number of corporations about their use of collaboration tools for employees and for customers
  - Integral to how we operate today
  - Cannot operate without online collaboration
  - Past the early adoption phase and the reluctance to participate has eroded

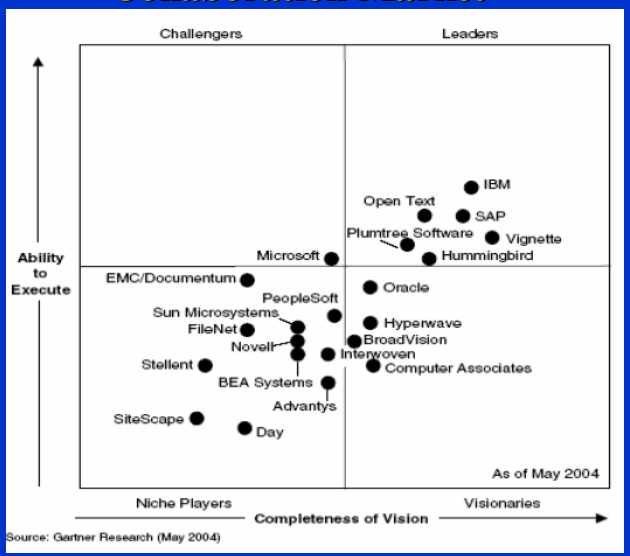
(Ambrozek and Cothrel 2004)

Collaborative Technology Trends

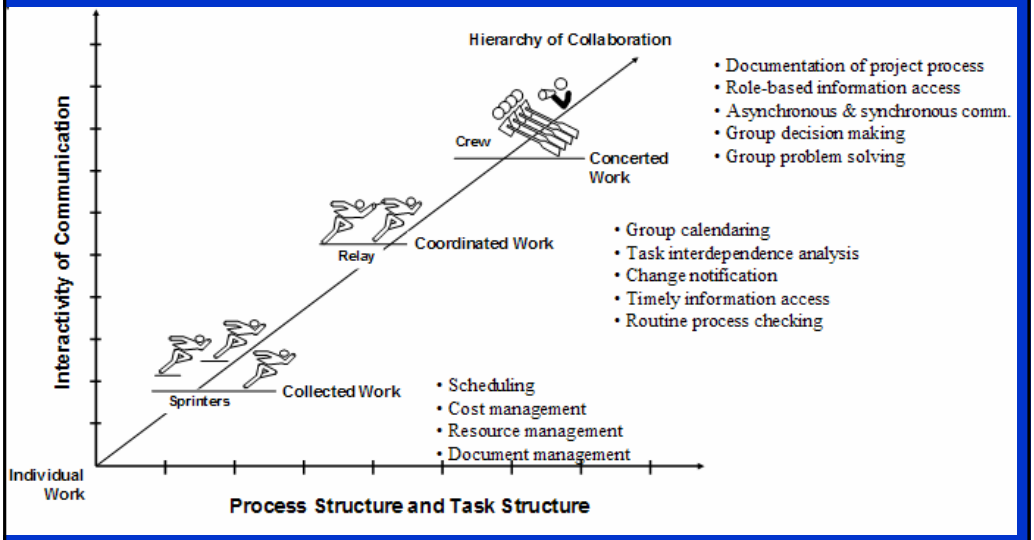


(Ambrozek and Cothrel 2004)

Collaboration Market



Collaboration Levels and PM Functions



(Chen et al. 2003 & Nunamaker et al. 2001)

Importance of Consistent Process Across Projects

- *"According to a February 2003 study by The Center for Business Practices (CBP), the largest PM challenge facing companies is **implementing a consistent process**…*
- *According to the Standish Group's CHAOS report that reviewed more than 40,000 projects in the last 10 years, **when there is not a consistent process for doing PM in a company, companies waste up to 20 percent of all project dollars spent**"*

(LaBrosse, 2004)

Intellectual Bandwidth Maturity (DM, CM, Process M)

Recall that Intellectual Bandwidth (IB) is

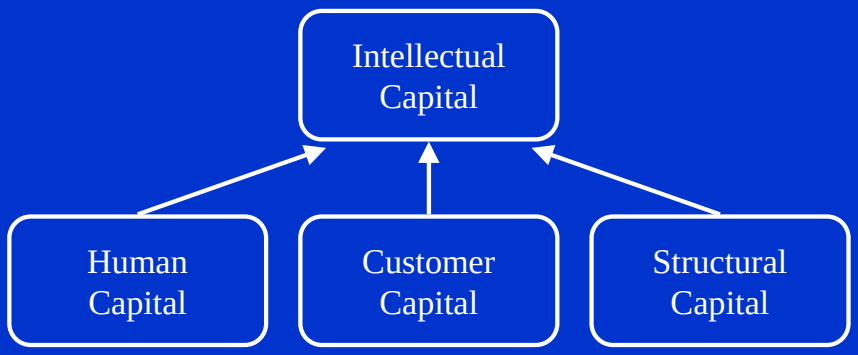
- *"a representation of all the relevant data, information, knowledge and wisdom available from a given set of stakeholders to address a particular issue."*
- The effective use of intellectual capital (IC) within the company

(Nunamaker et al. 2002)

IB Dimensions

- **Level of Understanding**
  - Consisting of Data, Information, Knowledge and Wisdom
- **Level of Collaborative Capability**
  - Levels of Individual, Collected, Coordinated and Concerted

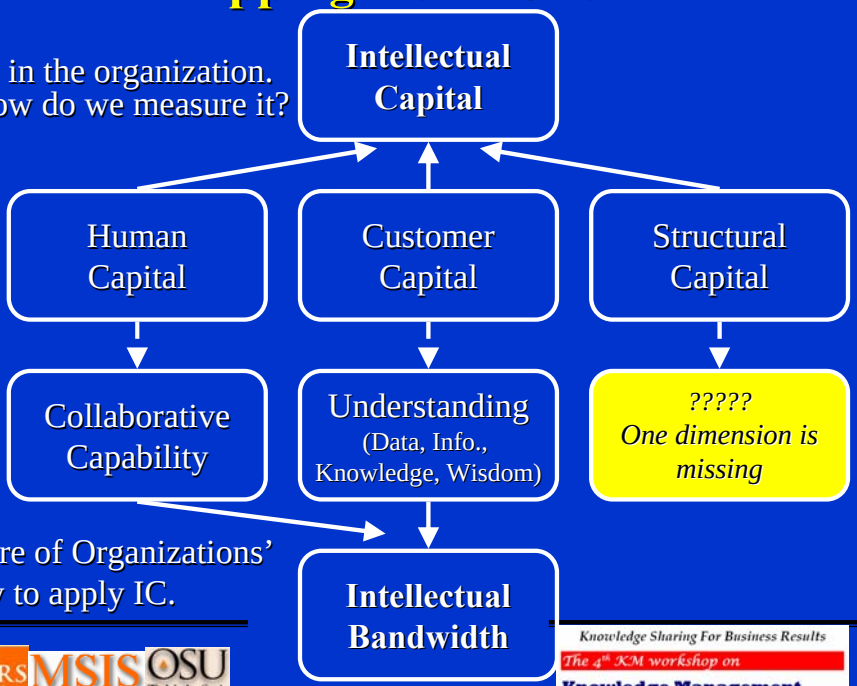
Components of Intellectual Capital (IC)



(Bontis1998)

Mapping from IC to IB

Exists in the organization.
But how do we measure it?



Measure of Organizations' Ability to apply IC.

Mapping from IB to IC model

- Human Capital→Level of Collaborative Capability
- Customer Capital→Level of Understanding (Data, Information, knowledge, Wisdom)
- Structural Capital→???

Need for New Dimension?

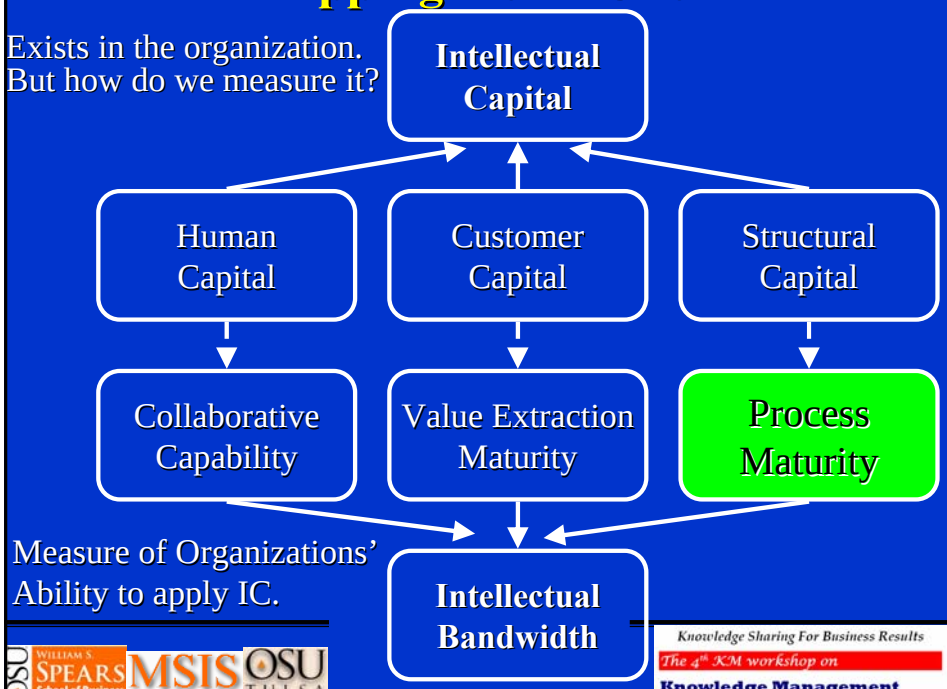
- Data collected and Collaborative efforts may not represent entire organizational knowledge
- What about capital residing in processes embedded within organizational routines?

Process Maturity Dimension

- Organizational processes represent significant organizational knowledge not captured by data or collaborative capability
- Processes also address structural capital component of IC
- Process maturity should be added to the existing IB model

Mapping from IC to IB

Exists in the organization. But how do we measure it?

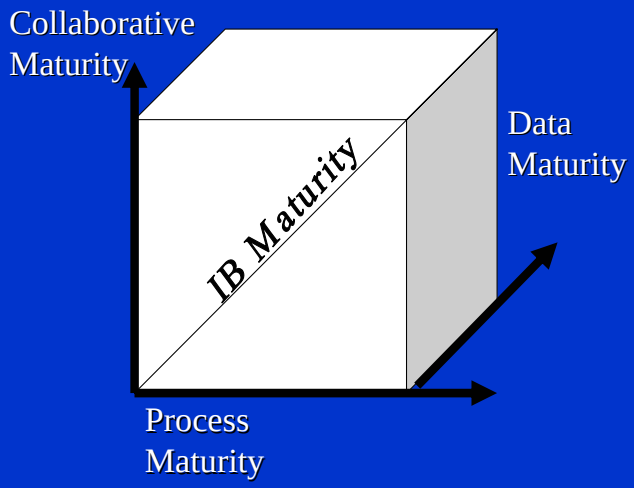


Measure of Organizations' Ability to apply IC.

IB Maturity Model (IBMM)

- An organization's level on each IB dimension represents the degree of maturity to which the organization employs knowledge within each dimension
- We can measure overall IB maturity by measuring it on each dimension

Dimensions of IBMM



Levels of Collaborative Maturity

- **Individual:** No Collaboration, everyone does own work
- **Collected:** Piecemeal tasks, all aggregated at the end
- **Communicative:** Conversational connections
- **Coordinated:** Success of some group members depends on timely completion of tasks by other members
- **Concerted:** All members work synchronously towards a single goal.

Levels of Value Extraction (*Knowledge*) Maturity

- **Data:** just collections of symbols.
- **Information:** Data collected is put into context and used to generate information that increases an organizations understanding of its business.
- **Knowledge:** Data and information collected over a period of time are analyzed to reveal recurring patterns in the organization's business processes. Increases confidence in using knowledge to make decisions.
- **Wisdom:** Wisdom lies in understanding the causes and consequences in patterns found. The wisdom level is achieved only through years of experience in the field

Levels of Process Maturity

- **Initial**: Characterized by ad-hoc processes
- **Repeatable**: Some company processes repeated mainly due to the fact that success has been found on previous occasions.
- **Defined**: Effort is made to define and document processes, such that a standard can be applied across the organization.
- **Managed**: Metrics collected to understand how well the documented processes are being followed
- **Optimized**: Organization mature enough to understand processes need to be continuously enhanced to optimize them for company use. Innovation and feedback from the processes are used to help optimize different processes.

(Software Engineering Institute 1995)

Instrument Development

- Initial questionnaire with 11 questions for collaborative maturity, 8 questions for process maturity and 8 questions for data maturity.
- Questionnaire was developed from the existing literature to ensure content validity.
- Subjected to a pretest (n=25).
- Purpose was to find out if the questions were worded correctly and to eliminate any existing ambiguity.
- The refined version consisted of 9 questions on collaborative maturity, 8 questions on process maturity and 8 questions on data maturity.

Collaborative Maturity Items

CM1	Most work done in my organization involves group work
CM2	A high percentage (almost 75%) of the work performed in my work unit requires group participation.
CM3	There is a high degree of communication among the members of my work unit.
CM4	Members of the work unit do their tasks independently and at the end of the project all the work done is put together as one project.
CM5	There is a high level of interdependency among tasks done by individual work unit members.
CM6	I need some tasks to be completed by my work unit members to be able to work on my part of the project.
CM7	Most work unit members cannot begin their tasks until some have completed their part of the project.
CM8	A high amount of work done by your work unit needs all members in your work unit to work at the same time and on the same task. (For example: Most work done by a decision-making committee (deciding on which equipment to buy) needs all its members to sit together and decide on what model, how many units etc.)
CM9	All work unit members work towards project completion simultaneously.

Process Maturity Items

PM1	Everybody in the work unit has a clear idea of what jobs (tasks) are done by others in the work unit.
PM2	There is a fixed way of doing most of the jobs (tasks) in the work unit. (Yes/No)
PM3	Most people in the work unit follow this fixed way of doing their job (or task).
PM4	There is an official document that outlines how a particular task should be done. (Yes/No)
PM5	Most people follow the documented way of doing the job (or task).
PM6	Information is collected to find out how well people follow the official document for doing their work.
PM7	This information is used to find problems and improve the documented process.
PM8	Every process in the official document is periodically monitored to find out ways to make it more efficient.

Data Maturity Items

DM1	Data related to the company's day-to-day activities (for example about customer, sales, manufacturing, defects etc) are collected.
DM2	Data collected is analyzed to generate information (like average sales for a branch, product with highest sales, most spending customer etc).
DM3	Information from data analysis is used to predict important information for the company. (For example sales for next month)
DM4	Decision makers in the company use some kind of data analysis or decision support systems to help them make decisions.
DM5	Wisdom gained due to experience of working in the same field is shared by organizing information exchange seminars.
DM6	Wisdom gained due to experience is put into written form to capture knowledge of experienced employees.
DM7	All work units in the company use a central repository to store information regarding the problems they faced and the solutions they found and used. Yes/No
DM8	This central repository is common knowledge and used by most people as the first alternative to find a solution when faced with a problem.

Analysis to Date

- Sample Size= 126+
- Reliability Analysis
  - Collaborative Maturity Scale = 0.7
  - Data Maturity Scale = 0.82
  - Process Maturity Scale = 0.89
  - Overall Reliability = 0.84
- Exploratory Factor Analysis and Confirmatory Factor Analysis have been conducted to purify the instrument

Use of IBMM

- Understand how well resources within the organization are being harnessed and to measure the organization's performance on various dimensions of IB maturity
- Provides a more complete picture of Intellectual Capital of the organization than the previous models
- Can be evaluated on a group/project level to understand if individual intellectual capacities are, in fact being pooled and utilized to make better decisions.

Future Research

- More Theoretical development
- Test the Model across cultures
  - We have done this AMCIS paper in Refs
- Other ideas are welcome

What is needed is a Collaborative PM/KM Architecture

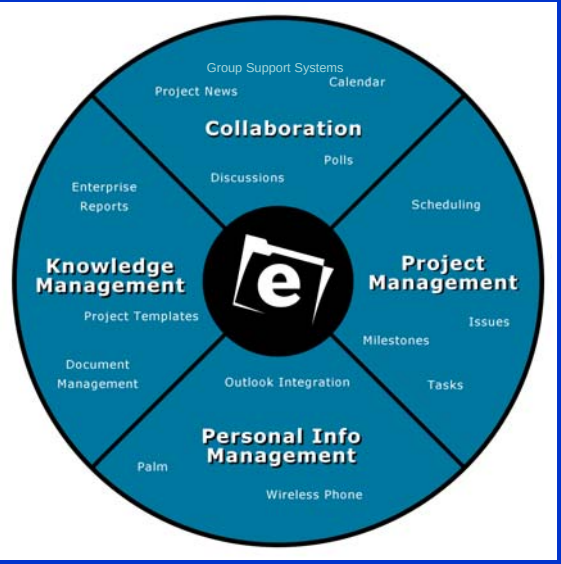
An Integrated Solution is Needed

Collaboration
- Project News
- Calendar
- Polls
- Discussions
- Group Support Systems

Knowledge Management
- Enterprise Reports
- Project Templates
- Document Management

Personal Information Management
- Outlook Integration
- Palm
- Wireless (WAP)

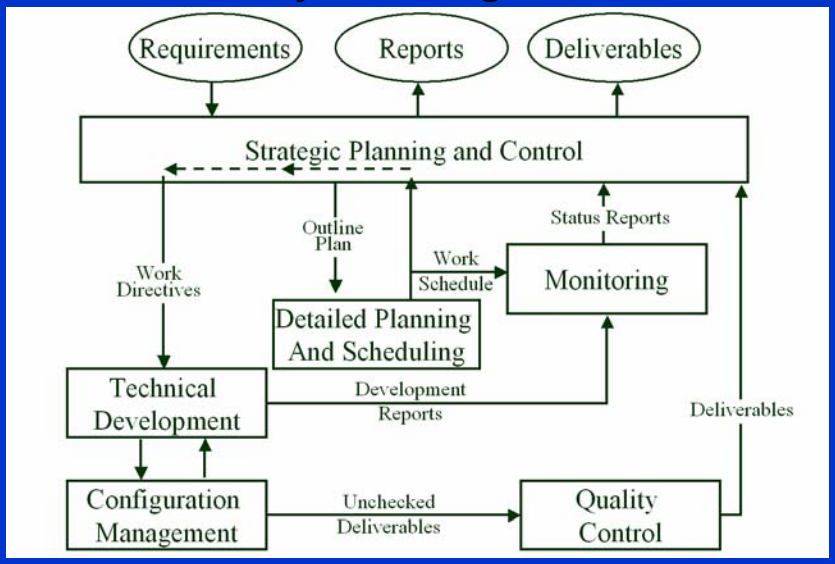
Project Management
- Scheduling
- Milestones
- Issues
- Tasks



Disciplines That Must Be Integrated

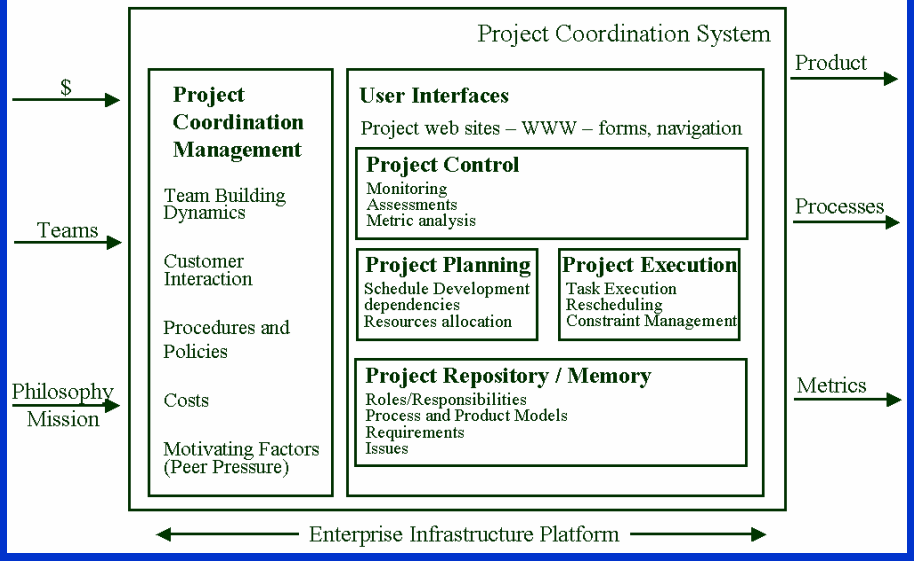
- **Planning and Executing Projects (Project Management)**
  - Defining the project objectives and goals
  - Scheduling tasks, milestones, and deliverables
  - Getting buy-in from stakeholders and team members
- **Working in Teams (Collaboration)**
  - Communicating with the entire project team
  - Sharing documents and tracking changes in new versions
  - Identifying and solving critical problems
- **Learning from Past Experiences (acquiring and storing knowledge)**
  - Developing best practices (templates) for future projects
  - Creating a knowledge base of issues encountered and recommended resolutions
- **Reporting Status and Results**

Dixon's Project Management Model

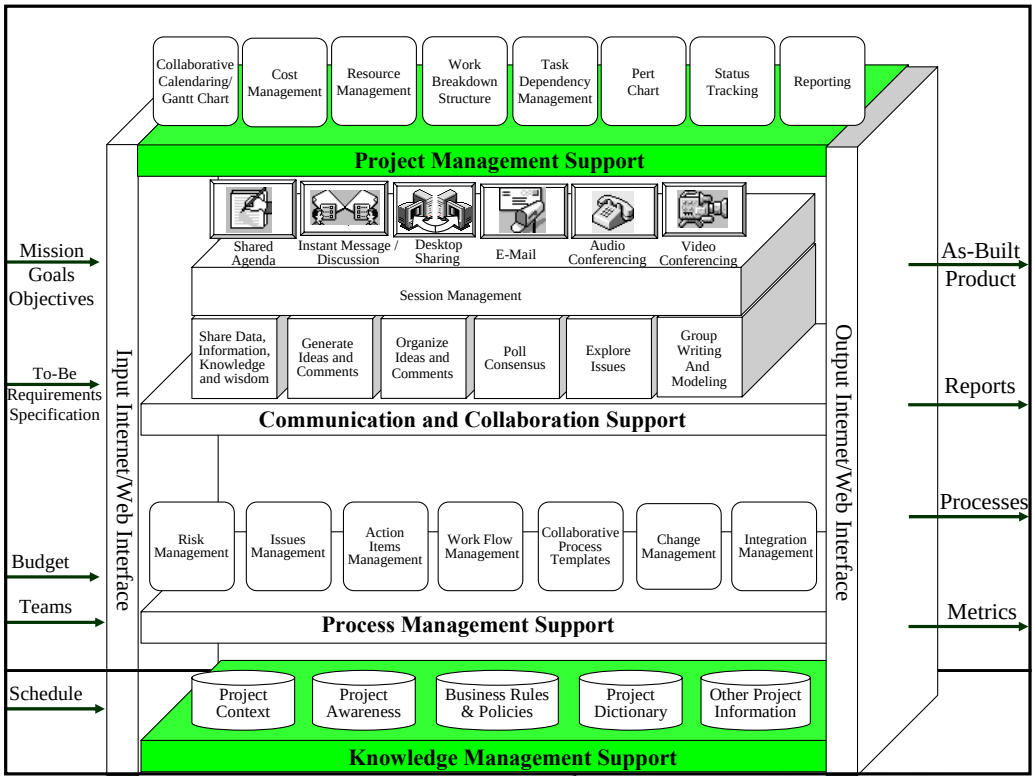


(Dixon, 1988)

Maurer's Project Coordination Model



(Maurer, 1996)



Four Major Components of Collaborative PM Approach

Components	Descriptions	Functions
PM Support	Scheduling, Time Management Resource Management Cost Management Task Analysis Task Allocation Status Tracking Reporting	Collaborative Calendaring / Gantt Chart Resource Management Cost Management Work-Breakdown-Structure Task Dependency Management , Pert Chart, Status Tracking Reporting
Knowledge Management Support	Develop High Levels of Project Awareness Project Dictionary Business Rules & Policies Project Context Info All Other Project-Related Info	Electronic Doc Repository With Functions of Uploading/Downloading Updating Searching (Key Word and Full Text Search) Browsing Document Version Control Role-Based Access
Process Management Support	Conduct Project Tracking and Increase Project Process Visibility	Work Flow Management Integration Management Change & Risk Management Issues Management Action Items Management Collaborative Process Structuring
Communication and Collaboration Support	Facilitate Communication in Synchronous & Asynchronous Mode, Group Decision Making, Problem Solving	Session Management Desktop Sharing Video & Audio Conference Support Idea Generation, Organization Consensus Polling Issue Exploration Group Writing and Modeling Shared Whiteboard

Collaborative PM as a Solution

Five CPM Success Factors

PM Employed as an **Analysis** tool

Manage Input, Output, and **Process**

Effective **Communication** and **Collaboration**

Proactive Management

Electronic Project **Repository**

Conclusion

- One PM Tool does not fit all projects
- A Customizable CPM Environment is needed
- A Library of CPM tools are required
- A CPM Architecture of Tools and Middleware for Collaborative work is required

Additional Resources

Published Venues of Interest

Published Venues of Interest

Papers co-authored by Nicholas C. Romano, Jr.

1. Beranek, P., J. Broder, N.C. Romano, Jr., S. Sump, and B.A. Reinig, Management of Virtual Project Teams: Guidelines for Team Leaders. Communications of the AIS, 2005. Volume 16(Article 10): 247-259.
2. Chen, F., N.C. Romano, Jr. and J.F. Nunamaker, Jr., An Overview of a Collaborative Project Management Approach and Supporting Software. in D. Galletta and J. Ross, (Eds.) Proceedings of the Americas Conference on Information Systems. 2003. Tampa, FL, USA: Association for Information Systems. 1303-1313.
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4. Chen, F., N.C. Romano, Jr. and J.F. Nunamaker Jr., A Collaborative Project Management Approach and Supporting Software Architecture. Journal of International Technology and Information Management, 2006. Forthcoming.
5. Romano, N.C., Jr., F. Chen, and J.F. Nunamaker, Jr. Collaborative Project Management Software. in R.H.J. Sprague and J.F.J. Nunamaker, (Eds.) Proceedings of the Thirty-Fifth Annual Hawai'i International Conference on Systems Sciences. 2002. Wikoloa Village Kona, Hi: IEEE Computer Society Press. 234-243.
6. Romano, N.C. Jr. and J. Fjermestad, Collaborative Project Management: Challenges and Opportunities for Virtual Teams and Virtual Projects in E-Collaboration. International Journal of e-Collaboration, 2006. Forthcoming.
7. Schubert, P., U. Leimstoll, and N.C. Romano. Jr. Internet Groupware Systems for Project Management: Experiences from a Longitudinal Study. in R.T. Wigand, Y.-H. Tan, J. Gricar, A. Pucihar, and T. Lunar, (Eds.) Proceedings of the 16th Bled eCommerce Conference: eTransformation. 2003. Bled, Slovenia. 611-631 online at: http://e-business.fhbb.ch/eb/publications.nsf/id/224.
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Published Venues of Interest

Co-Chair – Minitrack on Distributed Collaborative Project Management (2003)
HICSS 2003 (in IEEE Digital Library)

Papers:
Fang Chen, Nicholas C. Romano Jr., Jay F. Nunamaker Jr. and Robert O. Briggs
A Collaborative Project Management Architecture

Kevin C. Desouza, Anuradha Jayaraman and J. Roberto Evaristo
Knowledge Management in Non-Collocated Environments:
A Look at Centralized vs. Distributed Design Approaches

Catherine Beise, Roberto Evaristo and Fred Niederman
Virtual Meetings and Tasks: From GSS to DGSS to Project Management

Published Venues of Interest

Co-Chair – Minitrack on Collaboration Issues in Cross-Organizational and Cross-Border IS/IT
HICSS 2006 (in IEEE Digital Library)
Papers:

Barbara Edington and Namchul Shin An Integrative Framework for Contextual Factors Affecting IT Implementation

Subrata Chakrabarty A Conceptual Model for Bidirectional Service, Information and Product Quality in an IS Outsourcing Collaboration Environment

Eric T. G. Wang, Jeffrey C. F. Tai and Hsiao-Lan Wei IT-Enabled Virtual Integration as a Mechanism for Mediating the Impact of Environmental Uncertainty on Supply Chain Performance

Akos Nagy Collaboration and Conflict in the Electronic Integration of Supply Networks

Élisabeth Lefebvre, Louis A. Lefebvre, Gaël Le Hen and Ralf Mendgen Cross-Border E-Collaboration for New Product Development in the Automotive Industry

Forthcoming Venues of Interest

Two Special Issues coming out in 2006 on Collaborative Project Management

Special Issue 1: **Collaborative Project Management: Virtual Teams and Virtual Projects**: Guest Edited by Jerry Fjermestad (NJIT) and Nicholas C. Romano, Jr. (OSU) International Journal of Electronic Collaboration (IJeC)

(Online at:) Forthcoming 2006.

Papers:

1: John McAvoy ( ) and Tom Butler ( ) *"A paradox of virtual teams and change: the implementation of the theory of competing commitments."*

2: Deepak Khazanchi (University of Nebraska Omaha) and Ilze Zigurs (University of Nebraska Omaha) *"Patterns for Effective*

Management of Virtual Projects: Theory and Evidence."

3: Irma Becerra-Fernandez (Florida International University), Martha Del Alto (NASA Ames Research Center), and Helen Stewart (NASA Ames Research Center) is *"A Case Study of Web-based Collaborative Decision Support at NASA."*

Two Special Issues coming out in 2006 on Collaborative Project Management

Special Issue 1: **Collaborative Project Management- Distributed and Outsourced Projects**: Guest Edited by Jerry Fjermestad (NJIT) and Nicholas C. Romano, Jr. (OSU) International Journal of Electronic Collaboration (IJeC) Forthcoming 2006.

(Online at:)

Papers:

1: Rafael Prikladnicki (Pontifícia Universidade Católica do Rio Grande do Sul – PUCRS – Brazil), Roberto Evaristo (University of Illinois at Chicago), Jorge Luis Nicolas Audy (PUCRS), and Marcelo Hideki Yamaguti (PUCRS) "*Risk Management in Distributed IT Projects: Integrating Strategic, Tactical, and Operational Levels.*"

2: Ganesh Vaidyanathan () "*Networked Knowledge Management Dimensions in Distributed Projects.*"

3: Boris Roussev (University of the Virgin Islands) and Ram Akella (University of California, Santa Cruz) "*Agile Outsourcing Projects: Structure and Management.*"

4: Kathy Schwaig, Steve Gillam, and Elke Leeds "*Project Management Issues in IT Offshore Outsourcing.*"

HICSS Minitrack Follow on JITTA Special Issue

Co-Chair minitrack on Cross-Organizational and Cross--Border Collaboration Forthcoming HICSS 2007

Co-Guest Editor Special issue of *Journal of Information Technology Theory and Application (JITTA)* on Collaboration Issues in Cross-Organizational and Cross-Border IS/IT" to be published in Mid 2007.

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