Aalto University

BIM Collaboration

Information and Knowledge Management in Construction

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Aalto University, 7th March 2019

What is this session about?

- Overview of IM and KM in construction management
- Two complementary perspectives
- Implications for technology mediated projects

Recap

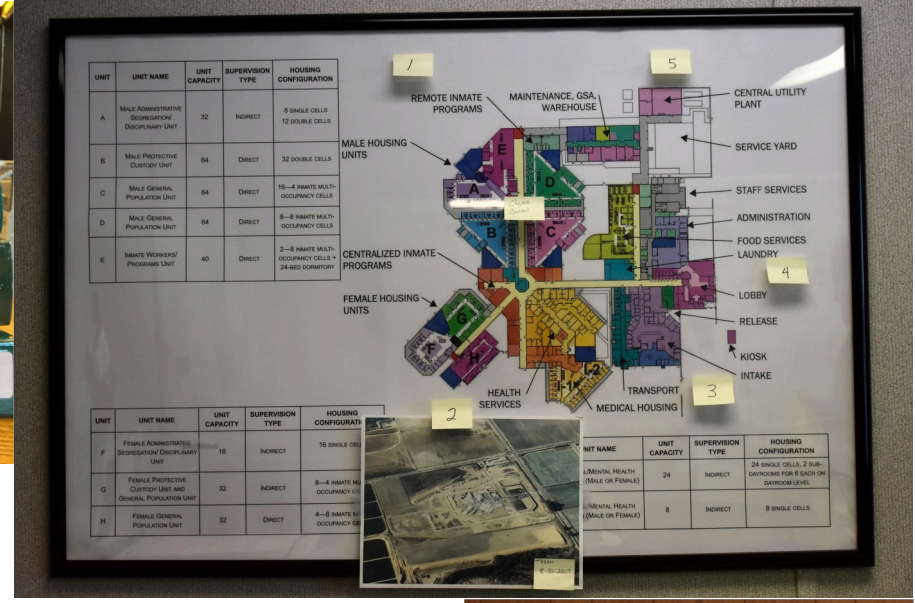
- Construction is largely **project**-based
- Industry is highly fragmented
- Needs high levels of coordination across numerous factors and actors
- Importance of last planners- workers
- Right People to Right job at the Right time **requires timely information sharing and access**

Information systems in AEC

- Computer Aided Design (CAD)
- Building Information Modelling (BIM) applications
- Project information management (PIMs)
- Document Management Systems (DMS)
- Enterprise Resource Planning (ERP) Systems
- eCommerce and eBusiness
  - B2B, B2C, C2C, …
- Emails, instant messaging and chats, …
- Tracking, monitoring and sensing devices…

What else can you think of as part of projects and organizations IM and KM practice?


2015 IPC
INTERNATIONAL PLUMBING CODE
2015 IMC
INTERNATIONAL MECHANICAL CODE
2015 IECC
INTERNATIONAL ENERGY CONSERVATION CODE
2012 IGCC
INTERNATIONAL GREEN CONSTRUCTION CODE
2015 IFC
INTERNATIONAL FIRE CODE
2015 IRC
INTERNATIONAL RESIDENTIAL CODE
2015 IBC
INTERNATIONAL BUILDING CODE

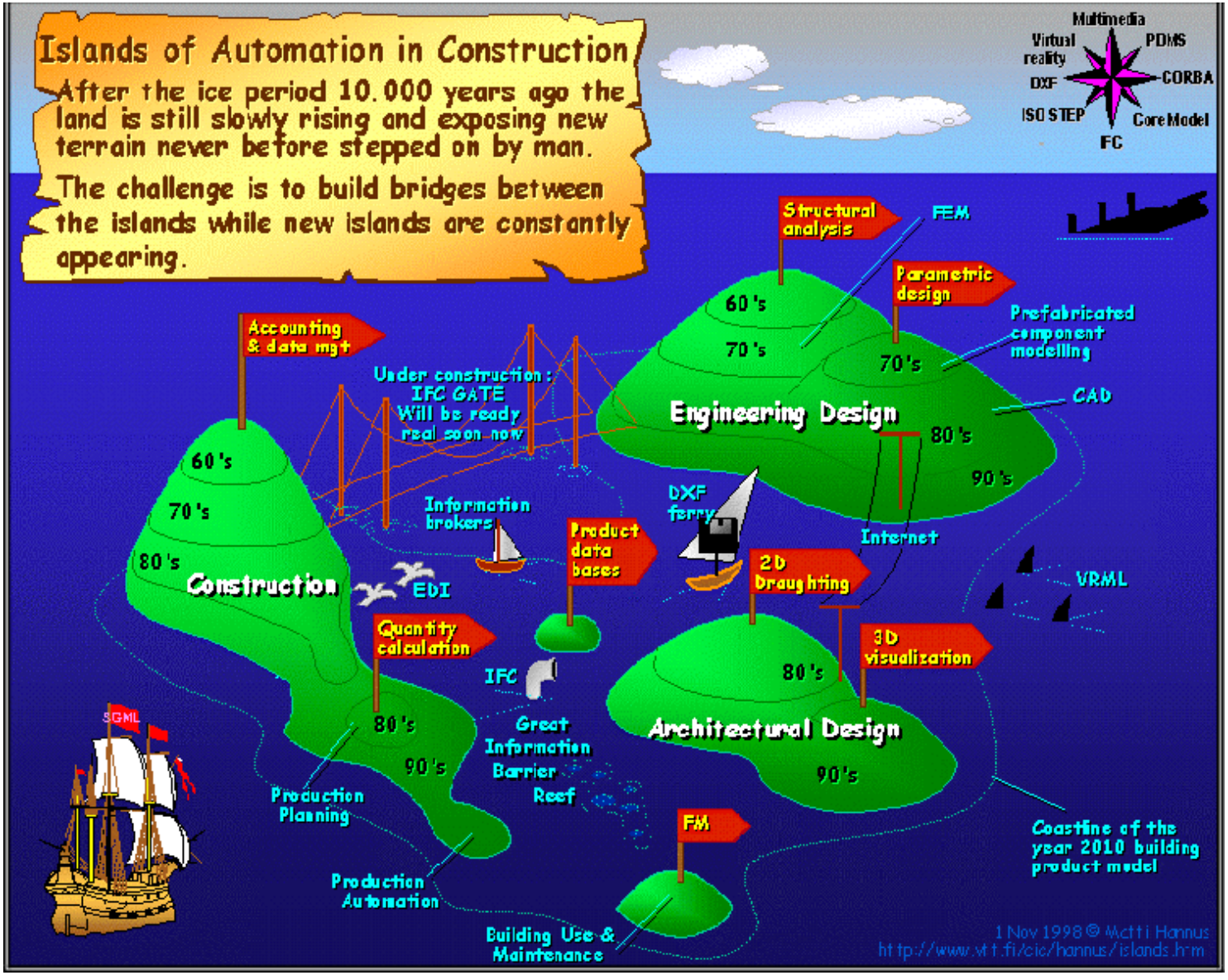

REMOTE INMATE PROGRAMS
MAINTENANCE, GSA WAREHOUSE
CENTRAL UTILITY PLANT
MALE HOUSING UNITS
SERVICE YARD
STAFF SERVICES
ADMINISTRATION
FOOD SERVICES
LAUNDRY
CENTRALIZED INMATE PROGRAMS
LOBBY
FEMALE HOUSING UNITS
RELEASE
KIOSK
INTAKE
HEALTH SERVICES
TRANSPORT
MEDICAL HOUSING


This is the Required P.P.E. for this site!
YOUR LOGO HERE
Safety Helmet
Eye Protection
Protective Gloves
High Visibility Clothing
Laced Safety Footwear
NO EXCUSES

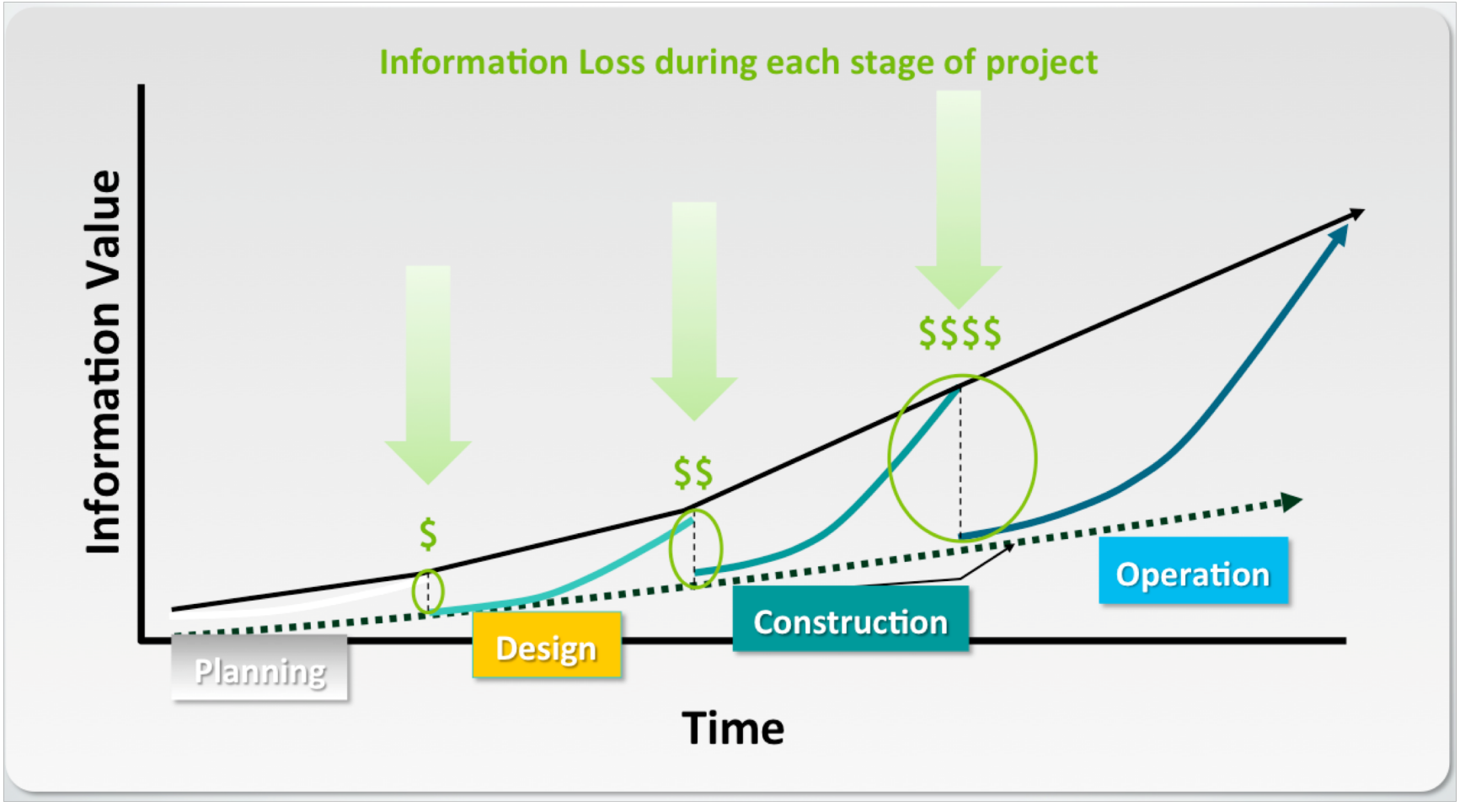

Signs Brisbane QLD Construction Signs
DANGER
CAUTION
DANGER
DANGER HIGH VOLTAGE
CAUTION HAZARDOUS AREA AUTHORIZED PERSONNEL ONLY
DANGER HARD HAT AREA
DANGER CONSTRUCTION AREA KEEP OUT
DANGER RADIATION
DANGER DO NOT ENTER
Call (07) 3205 7720


SITE SAFETY
Construction work in progress Parents are advised to warn children of the dangers of entering this site
Danger Demolition work in progress
No admittance for unauthorised personnel
Use ear protectors
This is a hard hat area
High visibility jackets must be worn
Protective footwear must be worn
Warning Look out for overhead loads


LAST WEEK

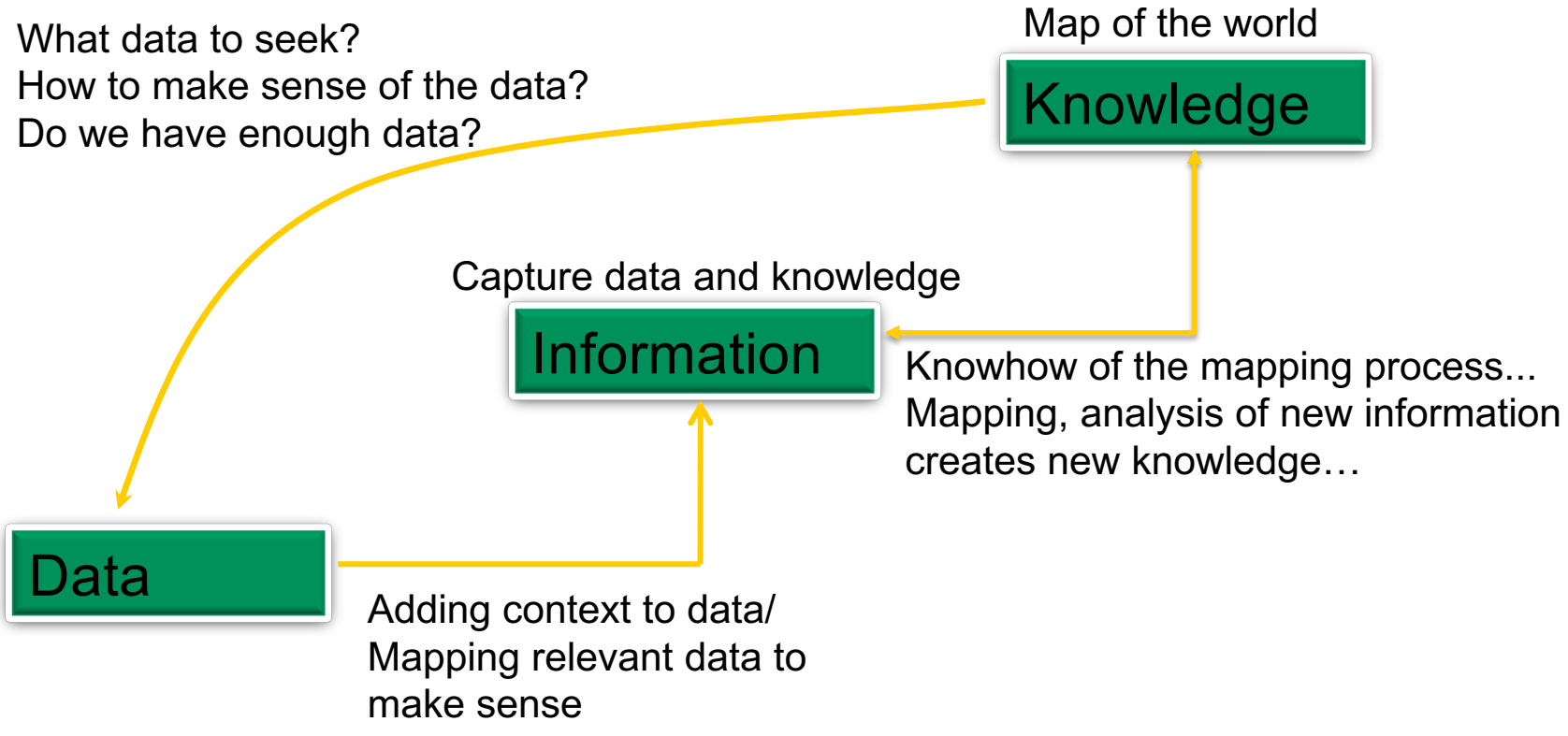

Islands of Automation in Construction
After the ice period 10.000 years ago the land is still slowly rising and exposing new terrain never before stepped on by man.
The challenge is to build bridges between the islands while new islands are constantly appearing.
Multimedia
Virtual reality
PDMS
DXF
CORBA
ISO STEP
Core Model
FC
Structural analysis
FEM
Parametric design
Prefabricated component modelling
CAD
60's
70's
70's
Engineering Design
80's
90's
Accounting & data mgt
Under construction: IFC GATE Will be ready real soon now
60's
70's
80's
Construction
Information brokers
EDI
Product data bases
DXF ferry
Internet
2D Draughting
VRML
Quantity calculation
IFC
3D visualization
80's
Architectural Design
90's
80's
90's
Great Information Barrier Reef
Production Planning
Production Automation
FM
Building Use & Maintenance
SGML
Coastline of the year 2010 building product model
1 Nov 1998 © Matti Hannus
http://www.vtt.fi/cic/hannus/islands.htm

Information loss between project phases



Information management- basics

Data- Information-Knowledge


What data to seek?
How to make sense of the data?
Do we have enough data?
Map of the world
Knowledge
Capture data and knowledge
Information
Knowhow of the mapping process...
Mapping, analysis of new information
creates new knowledge…
Data
Adding context to data/
Mapping relevant data to
make sense

	T1	T1	T1	T1	T2	T2	T2	T2
	Lec 1	Lec 2	Lec 3	Lec 4	Lec 5	Lec 6	Lec 7	Lec 8
Attendance?	30	20	18	15	20	26	25	26
Temp?								

IM and KM in construction projects

Information and Knowledge about what?

Products

Processes

People

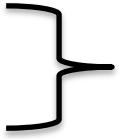
Policies
Partners
Projects
Plans
Places
Procurements
Permits
Prices
Phases

Contracts
Collaboration
Coordination
Communication

Project level
Organizational level
Industry level

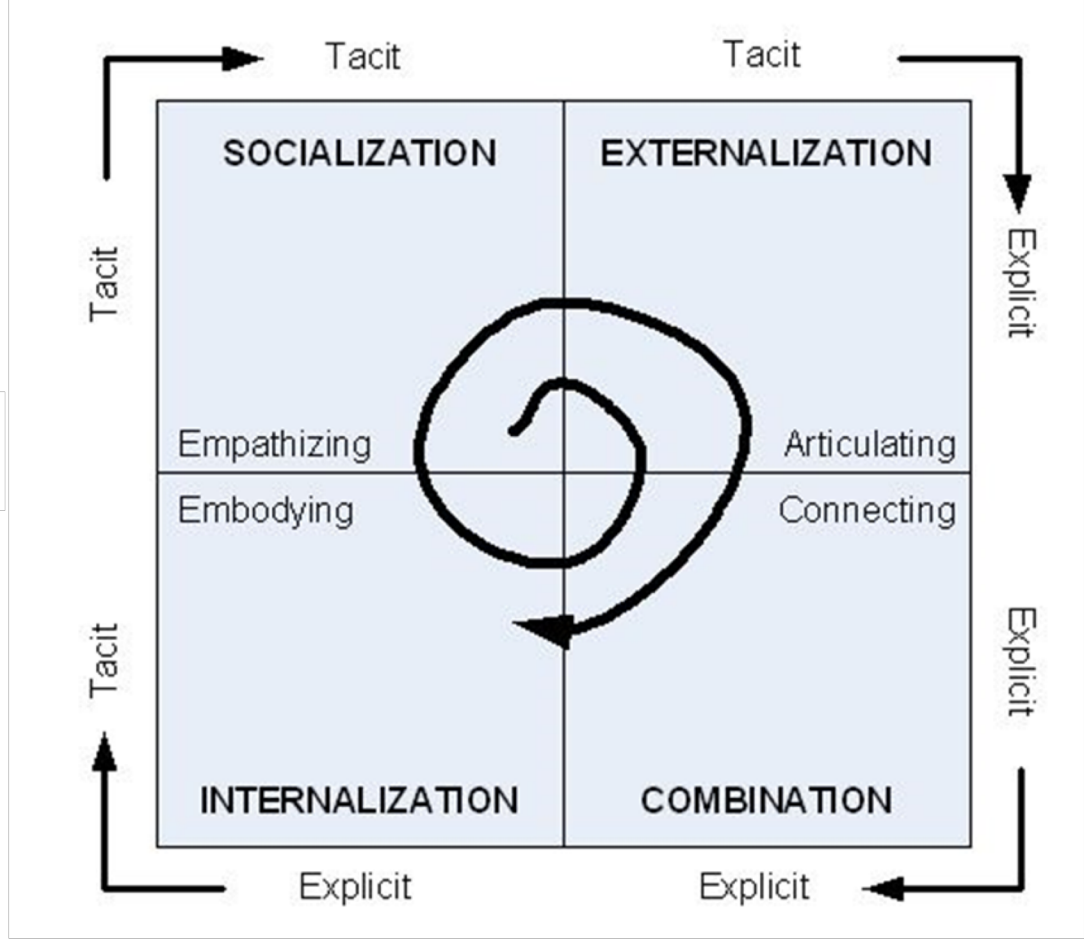
Knowledge management perspectives

Knowledge creation
Knowledge distribution
Knowledge acquisition
Knowledge application
Knowledge transfer



Knowledge creation cycle

The SECI model
By Nonaka and Takeuchi



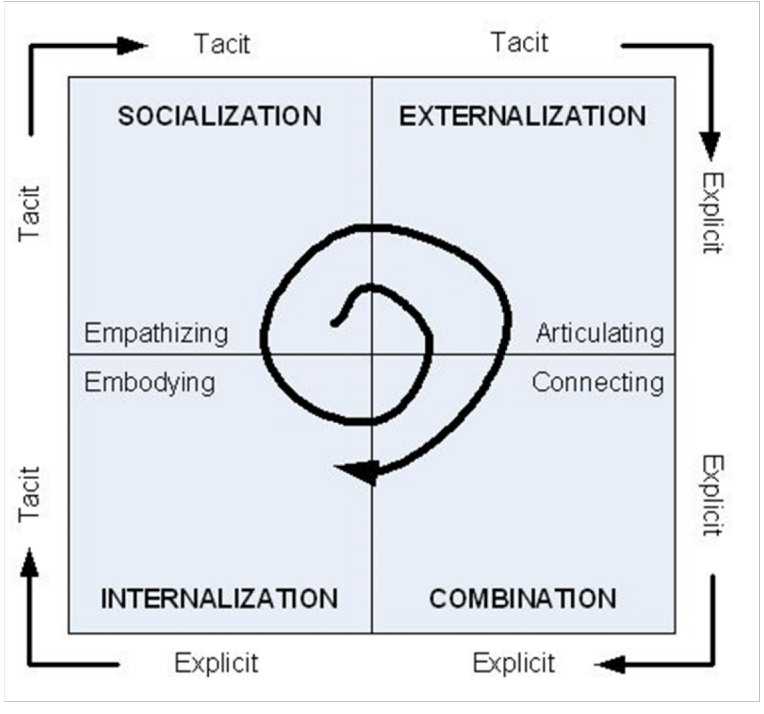
Knowledge creation cycle- About design/ product

Who? Designers, consultants, site engineers…

What? design features, concepts, strengths and weaknesses, rules (thumb-rules to standards)…

When? Where?

How to bring from site to office? From field and practice to classrooms?



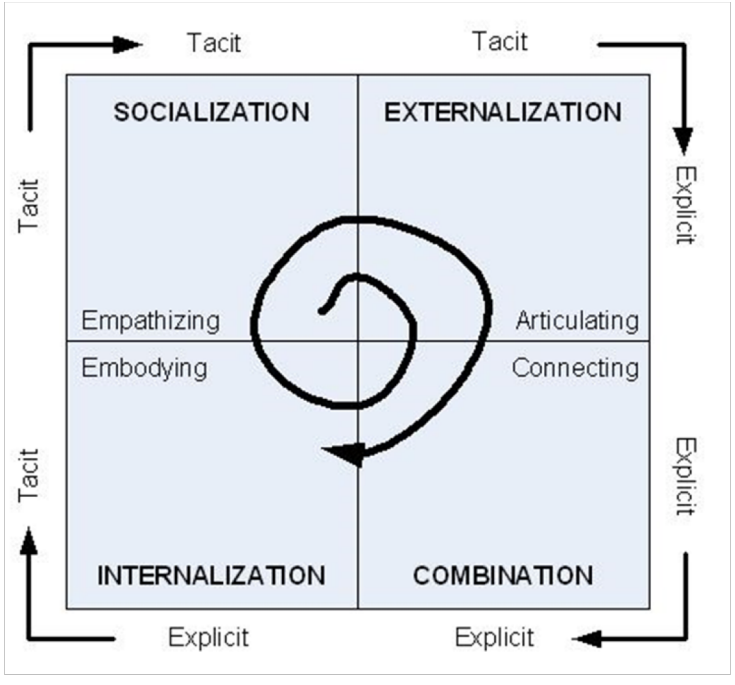
Knowledge creation cycle- About the process

Who? Designers, consultants, site engineers…

What? Best practices (thumb-rules to guidelines and protocols), Do's and Don'ts …

When? Where?

How to bring from site to office? From field and practice to classrooms?



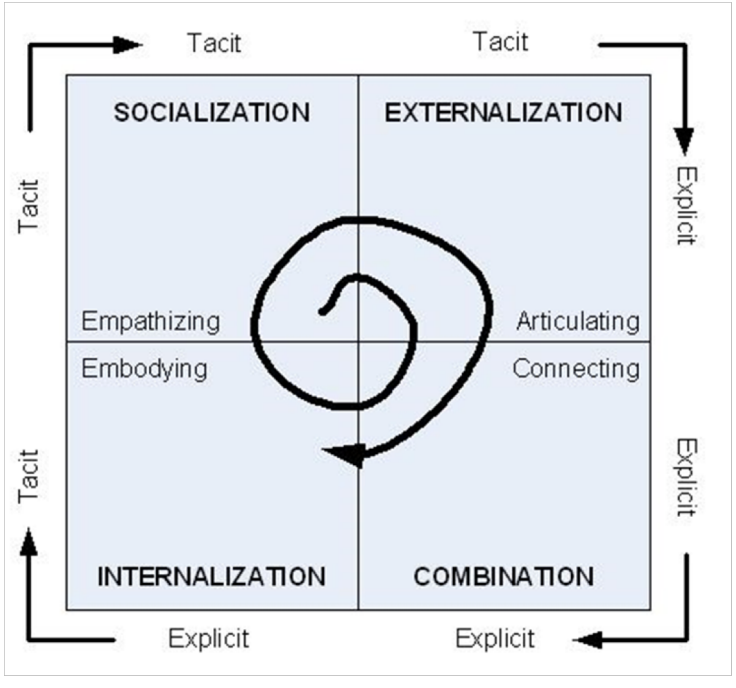
Knowledge creation cycle- About project management

Who? Designers, consultants, modelers…

What? Best practices (guidelines and contracts), Do's and Don'ts, updates in tools …

When? Where?

How to bring from practice to tools?

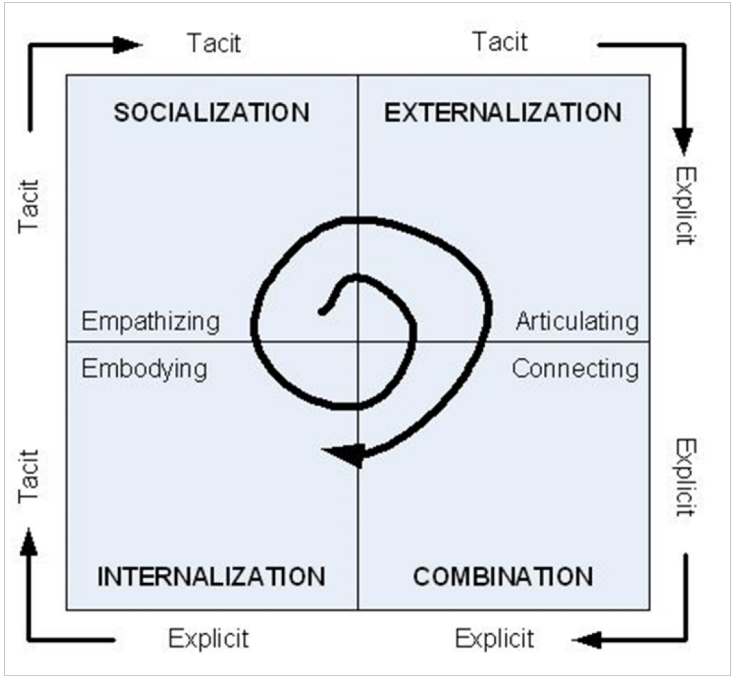


Knowledge creation cycle- About the project team

Peer to peer referrals

Does it get externalized? Any examples?

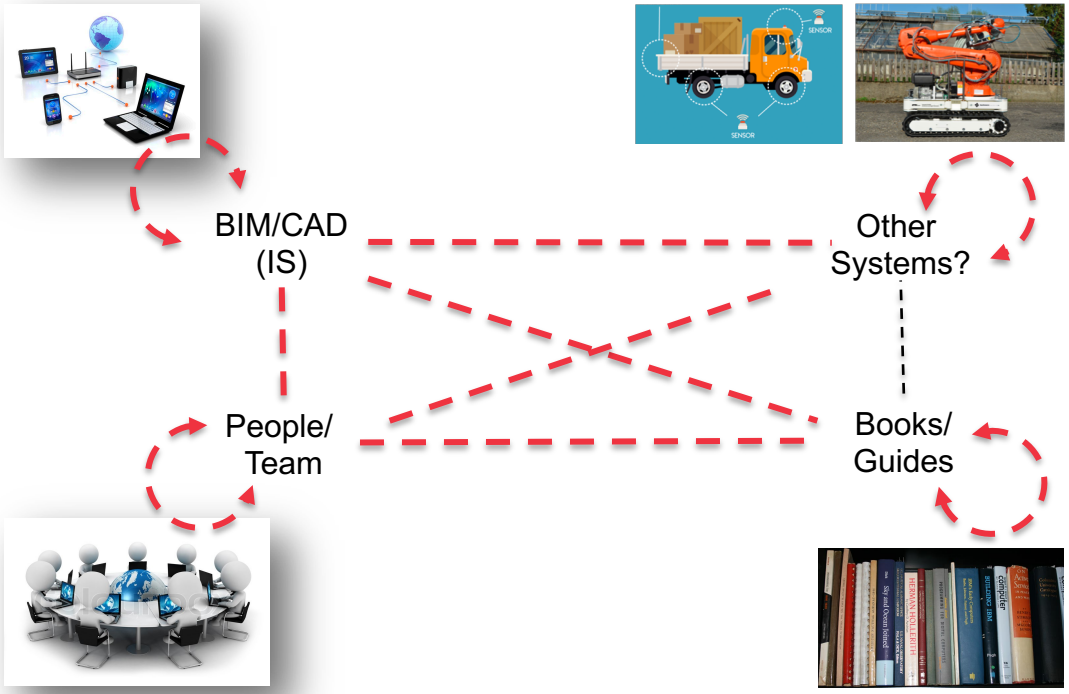
What is combined?



Managing distributed Information and knowledge

Distributed knowledge management

- Distributed knowledge
- What, who, where, how, and when?



Distributed knowledge management- What are the critical factors?

- Connectivity and access
- Allocation, **sharing** and redundancy
- Accuracy, reliability and trustworthiness
- Sufficiency of knowledge/ information
- Information quality/loss in transfer
- Updates and relevance
- Backup…

Connectivity and access

- How **often** do project team members **need to** connect and access information from other project members or an information system?

Is the team co-located or distributed? Is the connection between the team members formal or informal?

- How **easy or difficult** it is for a team member to connect with/ access another team member or an information system when needed?

Is the information on cloud or on the local machine? Is the information through a simple messaging tool, e.g. Whatsapp or is it in a BIM model?

- Are the different information systems able to talk to each other?

That is, what is interoperability of the different tools and applications?

Allocation, sharing and redundancy

- How well are the **roles and responsibilities distributed** in the team?
- Are there **duplications and overlaps** in roles and responsibilities of team members? Is it good or bad to have duplications?
- To what extent can some of your responsibilities be allocated to an information system? Example, remembering scheduled meetings, calculations, checking, etc?
- How often do users need to manually check and validate the calculations or other results from BIM and other applications?

Accuracy, reliability and trustworthiness

- How much do project team members trust the information provided by another project member or an external source?
- How accurate is the data or information stored-in or generated-by the following information system? How accurate or trustworthy is an old drawing?
- To what extent do you trust the computational operations performed by a BIM or similar application?

Centrality

- Who is the critical/ central member of the project, if any? How critical is the role of this person? Is this person the designated central person of the project, or is it because of the person's informal role?
- Is there a centralized information system in the project for project collaboration? Is all information exchange through this central information system?

Information quality/loss in transfer

Is the exchange of information clear between team members? To what extent is the information misinterpreted by others?

When you import or export data from one application to another, is there an information loss? Is the lost information critical?

Updates and relevance

- How updated are you about the changes and status of other's tasks, responsibilities and skills?
- How updated are you about the new features and changes in the information systems?
- Are your software and applications updated? Are the updates compatible with what other project members are using?

Backup

- How often do you backup the information related to your project? Where do you do it?

- Is there a backup or potential substitute for you in the project, in case you are not available anymore for the project?

Conclusion

- Projects are about coordinating knowledge and information
- Knowledge and information networks are both formal and informal
- Project-based teams add further complexity
- Coordination needs planning…
  - Various factors need to be considered in managing distributed knowledge

Questions?

Mandatory readings

Egbu, CO and Robinson, HS (2008) Construction as a Knowledge-Based Industry, In Knowledge Management in Construction, edited by Chimay J. Anumba, et al., John Wiley & Sons, Incorporated, 2008. ProQuest Ebook Central, http://ebookcentral.proquest.com/lib/aalto-ebooks/detail.action?docID=351237

Khanzonde, A and Senescu, R (2012) Making the Integrated Big Room Better, DPR Construction/ Stanford University, URL: https://www.dpr.com/view/making-big-room-better

Thank You!