Research Issues in Computing: Knowledge Management

Khurshid Ahmad

Professor of Computer Science
Department of Computer Science,
Trinity College, Dublin, Ireland.

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Some definitions

RESEARCH: A systematic search for facts; scientific investigation

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Some definitions

RESEARCH:

You think; you reflect; you write; you revise; you communicate; you receive feedback; you think; you reflect.....

Contents List

Knowledge Management

Introduction and Origins

Knowledge Work and Society

Corporate Learning?

Innovation Management

DEFINITIONS: KNOWLEDGE

"**The fact of knowing a thing, state, person; A state of being aware or informed; Consciousness".**

Shorter Oxford English Dictionary (1973)

Knowing is usually thought to involve believing, though some say that it *replaces* belief, or that we can believe one thing whilst somehow knowing the opposite. Some think that knowledge is justified true belief.

DEFINITIONS: MANAGEMENT

"The application of skill or care in the manipulation, use, treatment, or control of things or persons, or in the conduct of an enterprise, operation, etc.".

Oxford English Dictionary

DEFINITIONS: MANAGEMENT

Data → PROCESS → Information
Information → INTERPRET → Knowledge

Data → PROCESS (use ALGORITHMS + DATA STRUCTURES) → Information
Information → INTERPRET (use HEURISTICS & ALGORITHMS + REPRESENTATION SCHEMES)→ Knowledge

DEFINITIONS: MANAGEMENT

"The application of skill or care in the manipulation, use, treatment, or control of things or persons, or in the conduct of an enterprise, operation, etc.".

Oxford English Dictionary

DEFINITIONS: MANAGEMENT

identifying what knowledge assets a company possesses

Where is the knowledge asset? What does it contain? What is its use? What form is it in?

How accessible is it?

analysing how the knowledge can add value

What are the opportunities for using the knowledge asset? What would be the effect of its use?

What are the current obstacles to its use? What would be its increased value to the company?

specifying what actions are necessary to achieve better usability & added value

How to plan the actions to use the knowledge asset? How to enact actions? How to monitor actions?

reviewing the use of the knowledge to ensure added value

Did the use of it produce the desired added value? How can the knowledge asset be maintained for this use? Did the use create new opportunities?

DEFINITIONS

Knowledge

Language; Creativity;
Planning, Thinking,
Computation

Intelligence —————— Cognition
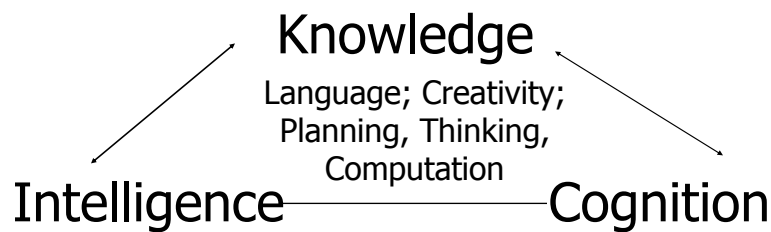
The Internet expedites communication & computation

DEFINITIONS

A new approach to the conservation and (rapid) deployment of the knowledge of organisations, expected to result in innovative, lean organisations.

DEFINITIONS

The effective management of knowledge expedites solutions to problems by involving a number of different people within an organisation at different levels, and every participant can, if authorised, look at the output of others within the organisation. The management of knowledge serves best when it helps to access knowledge of successful and failed projects, best practice and biographical details of the participants.

DEFINITIONS

• *Knowledge Management* - A term which was coined during the early 90s to discuss why Japanese companies had achieved such a dominant position.

• The term signalled the shift from the *industrial society* of the early 20th century, with its focus on *land, labour* and *capital* to a *knowledge-based* society which emphasised the human capital of an organisation.

COURSE OUTLINE

1. **Introduction & Origins**

2. **Knowledge Work & Society**

3. **Corporate Learning**

4. **Innovation Management**

5. **Best Practice**

INTRODUCTION & ORIGINS

Different metaphors to describe economic activity, productivity.

Consumption of chemicals: New products

Consumption of energy: New processes

'Consumption' of knowledge: New ?

INTRODUCTION & ORIGINS

Different metaphors to describe economic activity, productivity.

Consumption of chemicals: New products

Consumption of energy: New processes

'Consumption' of knowledge: New ?

INTRODUCTION & ORIGINS

Consumption & the management of consumed resource:

Raw material → Processing into finished goods→ Delivery → Sales → Profit?

'Consumption' of knowledge: New ?

Management

INTRODUCTION & ORIGINS

Consumption & the management of consumed resource:

Raw material → Processing into finished sevices/goods→ Delivery → Sales → Profit?

'Consumption' of knowledge: New ?

KnowledgeManagemer

INTRODUCTION & ORIGINS

According to management guru Peter Drucker, it was only at the beginning of the 20th century (c.1895-1905) that management was <u>distinguished</u> from ownership in Germany.

- Georg Siemens, a leading banker of his time, asked Werner Siemens to hand over control of latter's near-bankrupt electrical engineering enterprise to professional managers.

- Andrew Carnegie and John D Rockefeller followed suit in the USA. The period 1895-1905 coincides with the rise of the modern movement.

INTRODUCTION & ORIGINS

The post-modernist equivalent in the industrial genesis of the Northern Hemisphere was during the period spanning 1920-1950.

This genesis saw command-and-control structures introduced by the chemical giant du Pont, by General Motors - one of the pioneers of automotive engineering - and by the engineering colossus General Electric. Hierarchically organised enterprises emerged during this period (see Drucker 1988), coinciding with the ascent of post-modernism in the arts, literature, music and politics.

INTRODUCTION & ORIGINS

Computer mediated change management:

1. Changes in the economy, the society and perhaps the world at large, are sometimes precipitated by advances in science and technology;
2. Scientific and technological change is sometimes made possible by the use of computer systems – digital libraries, electronic communications are good examples here.
3. Can we use computers to monitor (and control?) how change is effected?

INTRODUCTION & ORIGINS

Classic Corporation and Industrial Society:

Frederick W. Taylor, a US engineer in the early part of the 20th century, suggested that an organisation can predict its output accurately from

- machine productivity;
- work processes; &
- time motion analysis of individual workers

THE WORKER WAS ESSENTIALLY VIEWED AS A UNIT OF PRODUCTION. ALL DECISION MAKING AND CREATIVE THOUGHT WAS THE RESERVE OF MIDDLE AND UPPER MANAGEMENT

INTRODUCTION & ORIGINS

In 19th and early 20th century wealth was associated with control of energy resources. Knowledge and information were regarded as parameters of economic systems rather than as variables within them.

Economic systems were construed as energy systems wherein cause and effect operate continuously and proportionately.

Knowledge and information are, by contrast, highly non-linear and disruptive.

INTRODUCTION & ORIGINS

Post-industrial Corporation & Society:

'Senior-level executives [have] come to understand the economic power of knowledge' Huseman and Goodman (1998:211)).

'KNOWLEDGE RESIDES AT ALL LEVELS OF ORGANIZATION. THE KNOWLEDGE ORGANIZATION REQUIRES AN ACCEPTANCE THAT PEOPLE AT THE TOP, OR EVEN A GROUP AT THE TOP, DO NOT CONSTITUTE THE REPOSITORY OF ALL KNOWLEDGE. SOMETIMES THE MOST VALUABLE KNOWLEDGE CAN BE FOUND AT THE LEVELS WHERE ORGANISATIONAL MEMBERS ARE CLOSEST TO CUSTOMERS AND SUPPLIERS (*ibid*:211-212)

INTRODUCTION & ORIGINS

Post-industrial Corporation & Society:

The introduction of the prefix 'post' in *post*-modern and *post*-industrial, is usually used to indicate a rupture from the past. The American Daniel Bell and the Frenchman Alan Touraine coined the term 'post-industrial' independently on either side of the Atlantic. Touraine wrote a book entitled *The Post-Industrial Society*(1970) to be followed by Bell's more evangelical title *The Coming of Post-industrial Society* (1973). According to Prof. Gibson Burrell of the Warwick Business School, Bell talks about an *expert class* and Touraine about *highly-skilled technicians.*

Burrell, Gibson. (1996). 'Hard times for the salariat'. In (ed.) Harry Scarbrough; pp52.)

INTRODUCTION & ORIGINS

The post-industrial society has emerged in a climate where multi-nationals move design and manufacture of goods around the globe with the deftness of ballet artists. The conventional wisdom of the post-modern age, that of **mass production** and **well-stocked warehouses**, has made way for *technologies* with idiosyncratic names: *just-in-time* or *kan-ban*, *lean manufacturing*, *business process re-engineering*, and the curious neologism *knowledge management* in the mid-1990s.

INTRODUCTION & ORIGINS

•**The term *knowledge management* is used to articulate the concept that knowledge is an asset on a par with the tangible assets of any organisation - land, capital, plant and machinery.**
•Management involves the control of assets, ergo knowledge should be managed from its inception through its nurturing to maturity to exploitation and to ultimate obsolescence.
•**Knowledge may be considered intangible and yet it has a lifecycle: conception-birth-maturity-death.**

INTRODUCTION & ORIGINS

	Post Modern Organisation	Post Industrial Organisation
Structure	PASSIVE, STATIC	REACTIVE, DYNAMIC
Products	DURABLE, DULL	DISPOSABLE, STYLISH
Consumer Needs	STABLE	CHANGING
Markets	GEOGRAPHICALLY WELL DEFINED	FUZZILY DEFINED
Competition	IDENTIFIABLE RIVALS: *WAR OF POSITION*	CHANGING RIVALS: *WAR OF MOVEMENT*

INTRODUCTION & ORIGINS:
CHANGE & MANAGEMENT

There are two major factors that have precipitated change during the second half of the 20th century:

- **Competition: International & Domestic**

- **Information & Communication Technologies (ICT)**

INTRODUCTION & ORIGINS:
CHANGE & MANAGEMENT

International Competition

1960's	The rise of Germany and Japan as major competitors of the US in automotive and white goods;
1980's	The rise of the Pacific Rim countries (& India) as major centres of manufacture, and of R&D;
2000+	The Internet-based 24-hour world-wide economy: *e-commerce* → *m-commerce*

INTRODUCTION & ORIGINS:
CHANGE & MANAGEMENT

Domestic Competition

Old Players & New Players:

IBM, DEC (†) Siemens, Philips

↓

Microsoft, SUN, Dell, SAP

Small-to-Medium sized Enterprises (SME):

SME's contribute extensively to economic and technological innovation

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INTRODUCTION & ORIGINS:
CHANGE & MANAGEMENT

Information & Comms. Technologies (ICT)

• **Moore's Law**: The number of transistors packed on a chip doubles every 18 months;

• Computer and communications technologies are *symbiotic*: one facilitates the provision of another;

• ICT is about data (1950s), information (1960s) and knowledge processing (1980s).

INTRODUCTION & ORIGINS:
CHANGE & MANAGEMENT
Information & Comms. Technologies (ICT)

Year	Processor	MIPS	Price ($)	Price ($) /MIPS
1975	IBM Mainframe	10	10,000,000	1,000,000
1976	Cray 1	160	20,000,000	125,000
1981	IBM PC	0.25	2,000	12,000
1984	SUN 2	1	10,000	10,000
1994	Intel Pentium	66	3,000	45
1998	Intel Pentium II	500	1,000	2

INTRODUCTION & ORIGINS:
CHANGE & MANAGEMENT
Information & Comms. Technologies (ICT)

Year	Host Computers on the (ARPA) Internet	Bandwidth
1969	4	9.6Kbps
1985	1961	56Kbps
1990	313,000	45Mbps (1989 data)
1995	6,642,000	155Mbps
1998	>10,000,000	1024Mbps
2000	?	2048Mbps

INTRODUCTION & ORIGINS:
CHANGE & MANAGEMENT

Key changes in which we transact:

Education	Distance Learning
Banking	Automated Teller Machines (ATM)
Retail	Point-of-Sale Terminals; Home Shopping
Entertainment	Virtual Reality
Business (Personal)	E-mail; e-commerce; m-commerce
Design/Diagnosis	Tele-presence
Education/Training	Virtual University

INTRODUCTION & ORIGINS:
CHANGE & MANAGEMENT

Terminology and symbols of change:

• *Realignment*: Mergers and acquisitions

• *Restructuring*: Reporting structures; organisational ethos

• *Downsizing*: Reducing work-force, investment, production capacity

↓

Material gain, sometimes short-term, at the expense of the loss of the intellectual capital

INTRODUCTION & ORIGINS:
CHANGE & MANAGEMENT

Instruments for:

ASSESSING organisational knowledge;

DEVELOPING and **FOSTERING** knowledge;

SHARING knowledge;

EVALUATING knowledge.

INTRODUCTION & ORIGINS:
CHANGE & MANAGEMENT
DEVELOPING and FOSTERING
knowledge **Within Organisations**

Facilitate:	**On-the-job training; Learning by doing; Job rotation; Career development**
Conduct:	Customer Satisfaction research; Market research;
Organise:	**Strategic Technology Study; R&D activities; External seminars & training;**
Evaluate:	Projects; People.
Promote:	**Cross-disciplinary interaction**

INTRODUCTION & ORIGINS: CHANGE & MANAGEMENT

DEVELOPING and *FOSTERING* knowledge *across Organisations*

Monitor:	Market activities; R&D activities; Technology developments
Network:	(at) Trade Shows, State-of-the-Art seminars; Technical Conferences;

INTRODUCTION & ORIGINS: CHANGE & MANAGEMENT

DEVELOPING and *FOSTERING* knowledge *across Organisations*

Knowledge Bottleneck: Where there are people there is not much new knowledge; where there is new knowledge, there are not many people.

INTRODUCTION & ORIGINS:
CHANGE & MANAGEMENT

DEVELOPING and *FOSTERING*
knowledge across Organisations

Knowledge Bottleneck: People don't find it easy to exchange information with each other: for social, economic, technological and linguistic reasons; time, money are key factors.

INTRODUCTION & ORIGINS:
CHANGE & MANAGEMENT

DEVELOPING and *FOSTERING*
knowledge across Organisations

Knowledge Bottleneck: Currently, it is not possible to exchange information in a timely, convenient and cost-effective manner.

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KNOWLEDGE WORK & SOCIETY

Peter Drucker introduced the terms *knowledge work* and *knowledge worker* in the 1960's. The term *knowledge management* refers to the management of the knowledge of the knowledge-workers.

KNOWLEDGE WORK & SOCIETY

Maximise the Enterprise's knowledge related effectiveness:
1. **Governance Functions**
2. **Staff Functions**
3. **Operational Functions**
4. **Valorization: Realising the value of knowledge.**

Knowledge Management Handbook –   J Leibowitz.

KNOWLEDGE WORK & SOCIETY

•**The term knowledge was usually used in the context of research and development – knowledge based on theory and laboratory experience. Drucker, Nonaka and Takeuchi, and others have extended the scope of the term by including knowledge based on experience and based on practice.**
•**The term *Knowledge work* was coined to distinguish this kind of work from *manual work*.**

KNOWLEDGE WORK & SOCIETY

Knowledge Society

The knowledge workers, their managers, the owners of the enterprises, and the customers of the goods, services and information produced by the enterprises, are interdependent on each other. It has been claimed that these 'players', in their interactions, develop edifices of culture and a kind of a society: the *knowledge society*.

KNOWLEDGE WORK & SOCIETY

Knowledge Society

Culture: Shared Values;
Exchange System
Kinship structures

Society: Compliance – Punishment &
Reward;
Organised group of people

KNOWLEDGE WORK & SOCIETY

Knowledge Society

Organisational structures and interactions within the organisation → Organisational Theory.

Information Processing within the organisation→ Psychological theory.

KNOWLEDGE WORK & SOCIETY

Knowledge Society

- The knowledge society, like others, demands a system of recruitment, values and their transmission from one generation to the next, and some means of enforcement and discipline.
  - The implication of the knowledge society is that there may be times when the society will expect the individuals to subordinate their interests, and sometimes perhaps their existence, to what may be perceived by the more persuasive members of the community to be in the wider society's best interests.
- The management of expertise, the key asset of the knowledge worker, appears to be the central concern amongst those who have reservations about the whole enterprise of the knowledge society.

KNOWLEDGE WORK & SOCIETY

Knowledge Society

- A society based on exchange of knowledge, based on structures that facilitate the exchange, and based on protocols for enforcing discipline and for rewarding achievements;
- Knowledge Society: Knowledge <u>of</u> an organisation?
- Do organisations have knowledge which is other than what individual members of the organisation have?
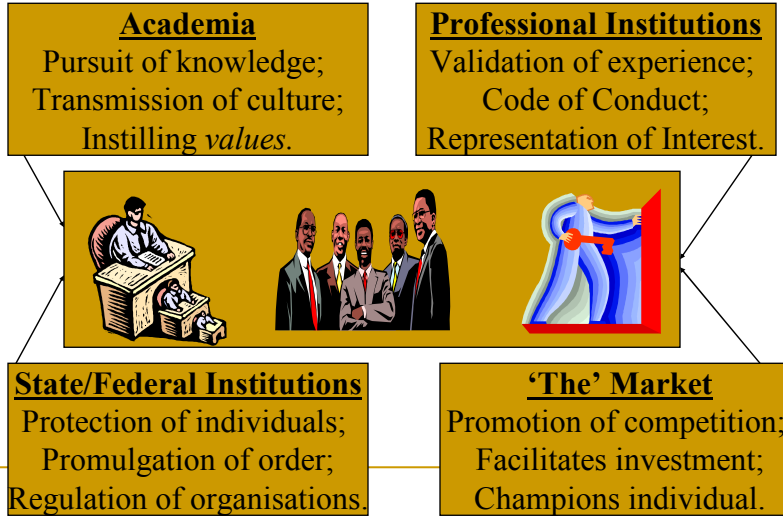
KNOWLEDGE WORK & SOCIETY

•Individuals have knowledge: facts, rules, theories, beliefs; know-how, skills; meta-knowledge for criticising and innovating upon existing knowledge.

•Individuals use organisations for physical and intellectual sustenance: for testing their knowledge and learning things new.

•Organisations have structures for physically and intellectually supporting individuals.

•Organisations can deploy knowledge, make it obsolescent, help in innovation.

KNOWLEDGE WORK & SOCIETY

•Knowledge of the individuals permeates through organisations:

- •Through hierarchies;
- •Through matrices;
- • Through networks;

•Knowledge permeates through these graphs (constellations of nodes and links) formal & informal mechanisms and processes.

CORPORATE LEARNING

Academia
Pursuit of knowledge;
Transmission of culture;
Instilling *values*.

Professional Institutions
Validation of experience;
Code of Conduct;
Representation of Interest.

State/Federal Institutions
Protection of individuals;
Promulgation of order;
Regulation of organisations.

'The' Market
Promotion of competition;
Facilitates investment;
Champions individual.

CORPORATE LEARNING

Can organisations learn? Organisational type

METAPHOR	*SALIENT FEATURES*
Organism	Mutation; Species; Competition; Genetic transmission; interaction between part & whole
Brain	Connectivity; Local and Global Interactions; Supervised/Unsupervised Learning
Culture	Ideology; exchange systems; morals; rules
Political System	Power distribution; Control of intellectual and material resources;
Autopoiesis	Autonomy; circularity; and self-reference; self renewal/self creation
Domination	Sub-ordination; Charisma; Rational-legal systems

CORPORATE LEARNING

Can organisations learn to learn?

Can organisations learn in an _on-going way?_

What are the main _barriers_ to learning?

Are these barriers intrinsic to the _nature_ of human organisation?

Can these barriers be _overcome_?

Does learning requires the ability to detect and correct errors:

- in relation to _set operating norms_?

- not only in relation to set operating norms but by _questioning_ the operating norms?

CORPORATE LEARNING

Can organisations learn to learn?

- Learning by instruction;

- Learning by experimentation;

- Learning by rote;

- Learning by observation;

- Learning from examples;

- Learning by doing;

- Learning by analogy;

- **Learning from mistakes and errors;**

CORPORATE LEARNING

Can organisations learn? Feedback and Control

Cybernetics is a subject that deals with the self-maintenance and self-control of systems, both mechanical and organic, through a feed-back process. Cyberneticians also study the communication of information in such systems.

Donald Schon (MIT) & Chris Argyris (Harvard) used the principles of cybernetics to provide a framework for thinking about *learning organisations.*

CORPORATE LEARNING

Can organisations learn? Feedback and Control

Control: In engineering it means to allow a machine to run within safe parameters and for the machine to operate efficiently.

Feedback: An important component of any dynamic system. The ability to take into account both the inputs and outputs of a system.

CORPORATE LEARNING

Can organisations learn? Feedback and Control

Single loop learning:

CORPORATE LEARNING

Can organisations learn? Feedback and Control

Double loop learning:

Data –Process→ Information
→ Interpret →
Knowledge ←based on ← Belief

CORPORATE LEARNING

Can organisations learn? Feedback and Control

Double loop learning:

Data –*Process*→
Information –*Interpret*→
Knowledge←*based on*←
Belief

CORPORATE LEARNING

Can organisations learn? Feedback and Control

Single loop learning:

The operation of a thermostat: The thermostat is constantly sensing, scanning and monitoring its environment (Step1); checking whether to (a) do nothing; (b) increase the heat; (c) decrease the heat (Step 2); the send an appropriate control signal to the energy source (Step 3).
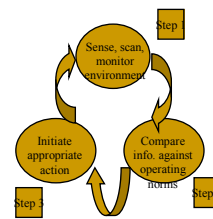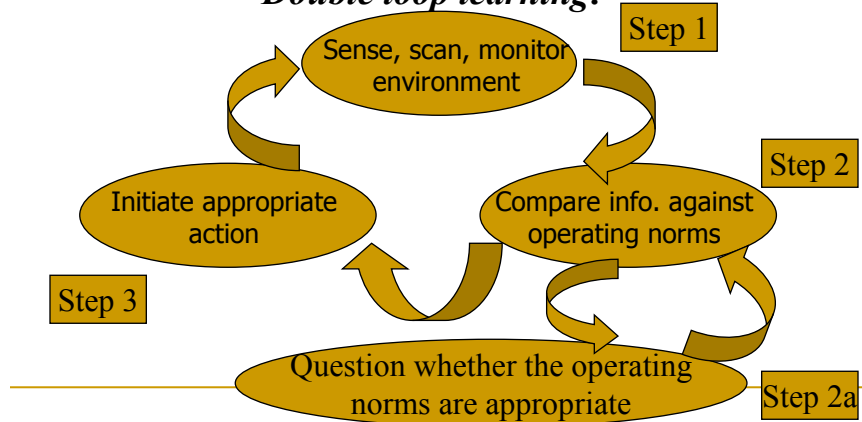
There are preset operating norms that can only be adjusted through an external agency. For instance: <=5 Centigrade turn heating on; >=10 C turn cooler on. Independent of changes in the environment.

Sense, scan, monitor environment

Compare info. against operating norms

Initiate appropriate action

Step 1

Step 2

Step 3

CORPORATE LEARNING

Can organisations learn? Feedback and Control
Double loop learning:

Step 1 — Sense, scan, monitor environment

Step 2 — Compare info. against operating norms

Step 3 — Initiate appropriate action
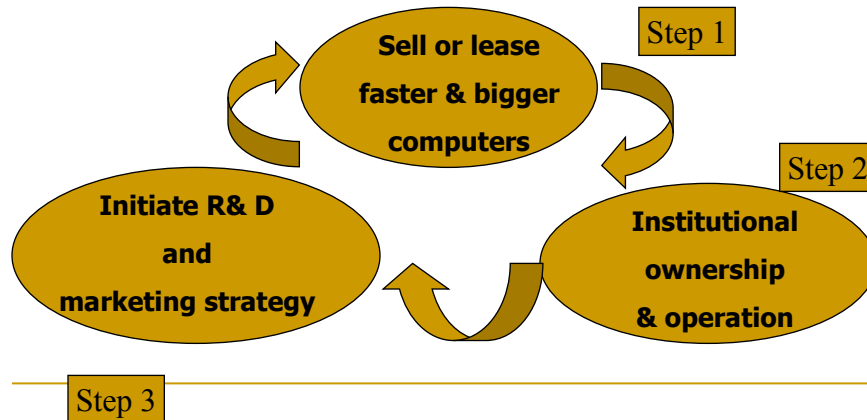
Step 2a — Question whether the operating norms are appropriate

CORPORATE LEARNING

Can organisations learn? Feedback and Control
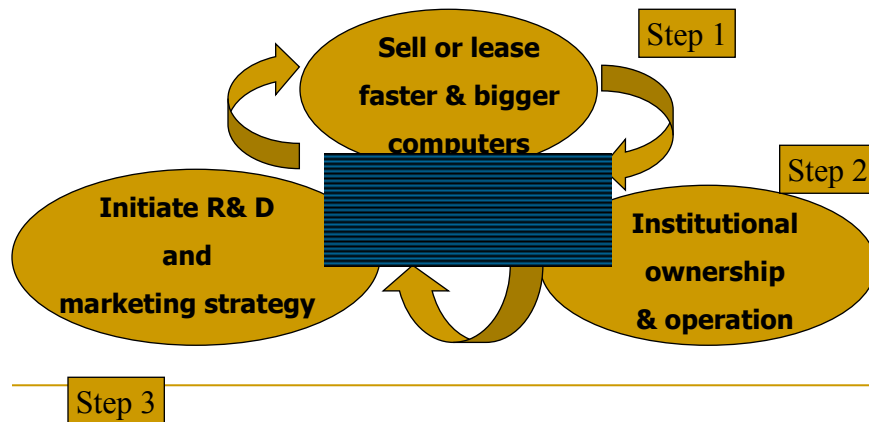### *Single loop learning in computing industry*

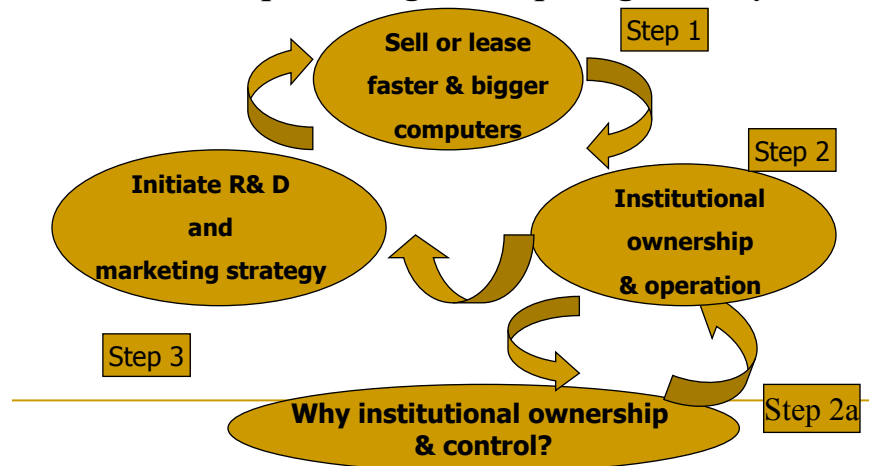Step 1 — Sell or lease faster & bigger computers

Step 2 — Institutional ownership & operation

Step 3 — Initiate R& D and marketing strategy

CORPORATE LEARNING

Can organisations learn? Feedback and Control
Single loop learning in computing industry

Step 1

Sell or lease faster & bigger computers

Initiate R& D and marketing strategy

Institutional ownership & operation

Step 2

Step 3

CORPORATE LEARNING

Can organisations learn? Feedback and Control
Double loop learning in computing industry

Step 1

Sell or lease faster & bigger computers

Initiate R& D and marketing strategy

Institutional ownership & operation

Step 2

Step 2a

Step 3

Why institutional ownership & control?

CORPORATE LEARNING

Can organisations learn? Feedback and Control

Double loop learning: In computing industry

Step 1

Sell or lease faster & bigger computers

Step 2

Institutional ownership & operation

Initiate R& D and marketing strategy

Step 3

Allow individual ownership & control

Step 2a

CORPORATE LEARNING

Can organisations learn? Feedback and Control

Double loop learning in computing industry

Step 1

SELL cheaper & faster computers

Step 2

Individual ownership & operation

Initiate R& D and marketing strategy

Step 3

CORPORATE LEARNING

Can organisations learn? Feedback and Control
Single loop learning: Apple's contribution
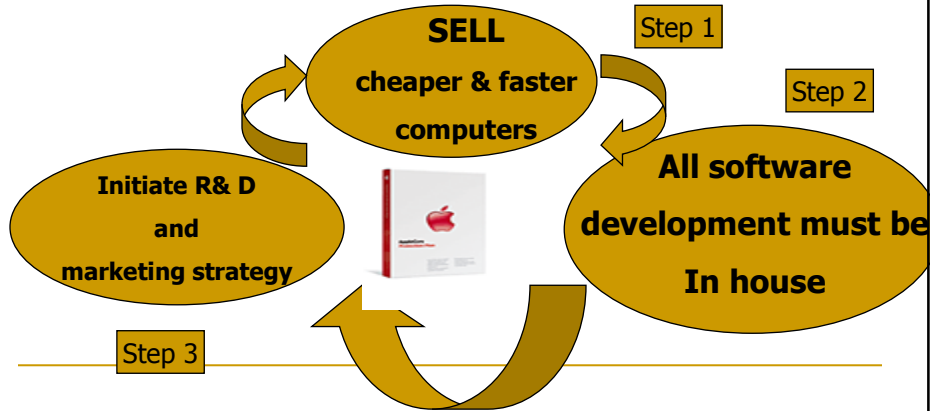
SELL cheaper & faster computers

Step 1

Step 2

Initiate R& D and marketing strategy

All software development must be In house

Step 3

CORPORATE LEARNING

Can organisations learn? Feedback and Control
Double loop learning in computing

SELL cheaper & faster computers

Step 1

Step 2

Initiate R& D and marketing strategy

All software development must be In house

Step 3

Should we allow others to develop software for our PC?
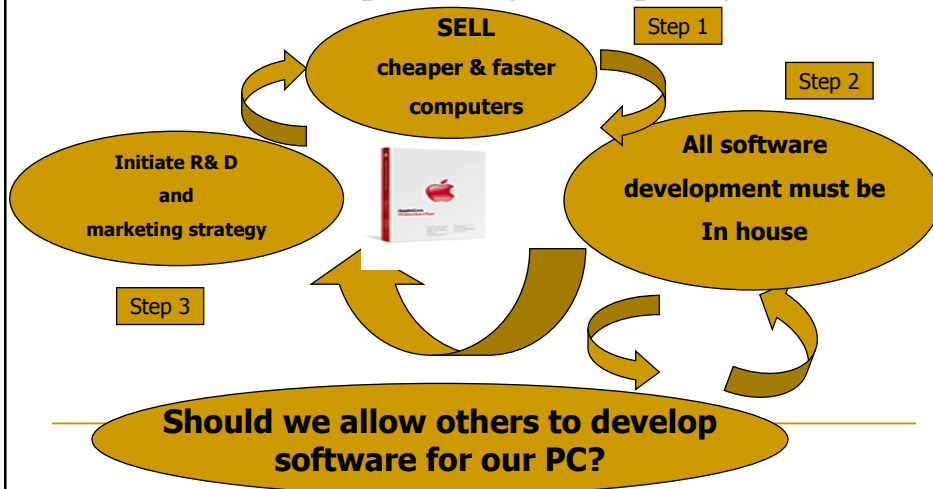
CORPORATE LEARNING

Can organisations learn? Feedback and Control
Double loop learning: IBM contribution

SELL cheaper & faster computers

Step 1

Step 2

Initiate R& D and marketing strategy

All software development must be In house

Step 3

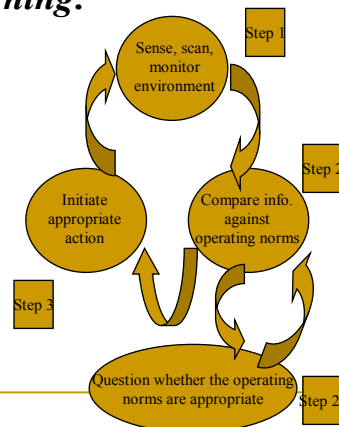We should allow others to develop software for our PC.
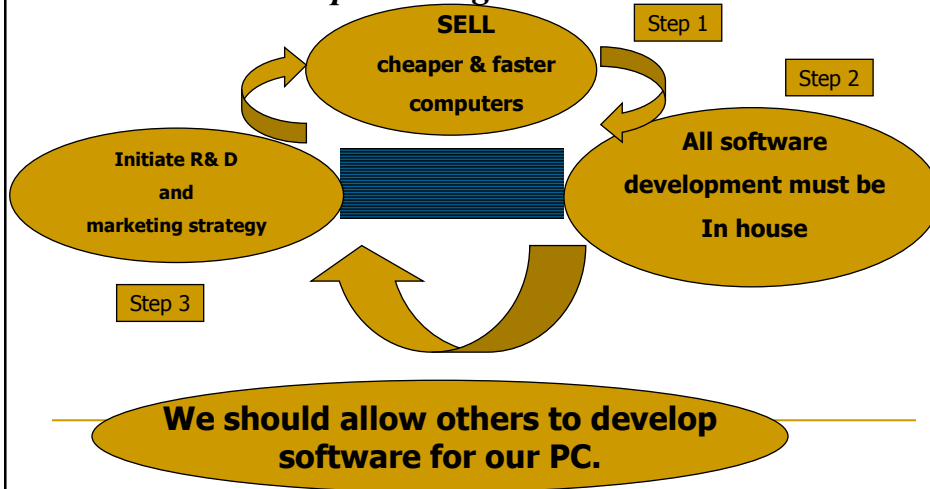
CORPORATE LEARNING

Can organisations learn? Feedback and Control
Double loop learning:

Double-loop learning is like a thermostat which can ask the question: Why have you set my operating norms as X C for hot and Y for cold? Although the thermostat questions it still goes on controlling the environment

Sense, scan, monitor environment

Step 1

Step 2

Initiate appropriate action

Compare info. against operating norms

Step 3

Question whether the operating norms are appropriate
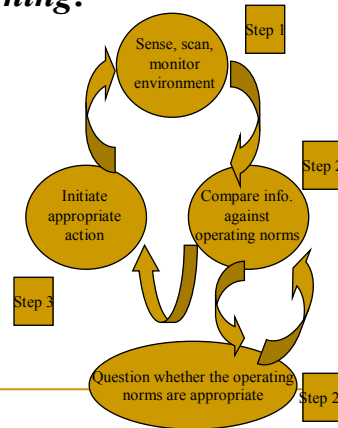
Step 2a

CORPORATE LEARNING

Can organisations learn? Feedback and Control
Double loop learning:

Challenge the norm but
attempt to preserve order
by noting *reference points*.

Questioning is important
but has to ensure that
organisation is consulted
as a whole.

CORPORATE LEARNING

Can organisations learn? Feedback and Control
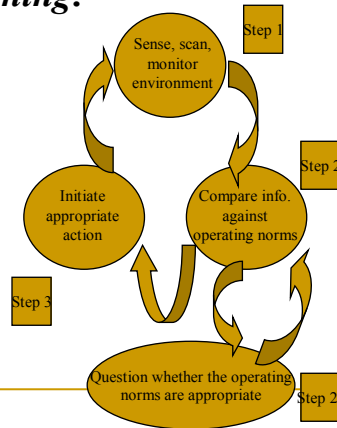
SELF
ORGANISATION

CORPORATE LEARNING

Can organisations learn? Feedback and Control
Double loop learning:

Brain as a metaphor for organisations is very relevant here in that the animal brain shows such a *self*-organising behaviour.
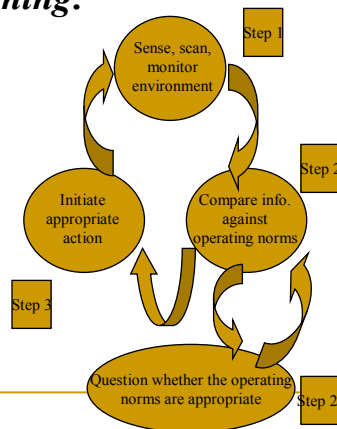
Step 1

Sense, scan, monitor environment

Step 2

Initiate appropriate action

Compare info. against operating norms

Step 3

Question whether the operating norms are appropriate

Step 2a

CORPORATE LEARNING

Can organisations learn? Feedback and Control
Double loop learning:

Defensive reasoning and the *doom loop*. (Agyris 1998:85)
Highly successful operatives, not used to failure create the information bottleneck – obstruct Step 2a.
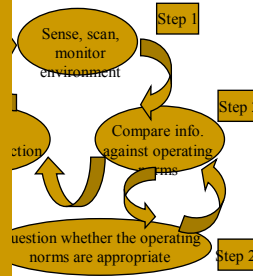
Step 1

Sense, scan, monitor environment

Step 2

Initiate appropriate action

Compare info. against operating norms

Step 3

Question whether the operating norms are appropriate

Step 2a

CORPORATE LEARNING

Can organisations learn? Feedback and Control
Double loop learning:

Knowledge Management:

Best Practice (Extant knowledge); Reuse

Innovation (New knowledge); Novel Usage

Life Cycle:

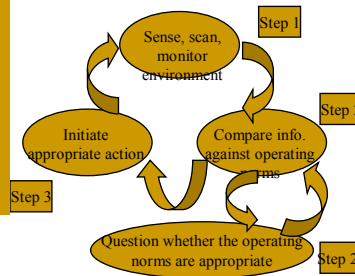Creativity (Inception) → Growth → Currency → Maturity → Decay and Obsolescence

Decay→ Pruning

Step 1
Sense, scan, monitor environment

Step 2
Compare info. against operating norms

...ction

Question whether the operating norms are appropriate
Step 2

CORPORATE LEARNING

Can organisations learn? Feedback and Control
Double loop learning:

Knowledge Management

(Creating & Sustaining plus Pruning)

Learning Organisations

Step 1
Sense, scan, monitor environment

Step 2
Compare info. against operating norms

Initiate appropriate action
Step 3

Question whether the operating norms are appropriate
Step 2

CORPORATE LEARNING

Can organisations learn? Feedback and Control
Single/Double loop learning:

Defensive reasoning and the *doom loop*. (Agyris 1998:85)

Defensive Routines: 1. Hold back bad news
2. Amplify good news
3. Tell people what they want to hear

Structures that encourage defensive reasoning:
a. Formal structures; Rules
b. Job descriptions
c. Groupthink → we are the best!

CORPORATE LEARNING

Can organisations learn? Feedback and Control
Double loop learning:

Knowledge Management:

Facilitate a transparent flow of information;
Facilitate easy exchange of information;
Facilitate easy recall of information;
Facilitate access to forecasting, modelling and simulation systems

What then?

Allows an organisation to involve workers at all levels to share information;
Allows an organisation to share information about the inputs and reactions to its outputs primarily from the customers

CORPORATE LEARNING

Can organisations learn? Feedback and Control
Double loop learning:

Feedback on **current** operations and existing norms
Positive feedback: More leads to more; less leads to less;
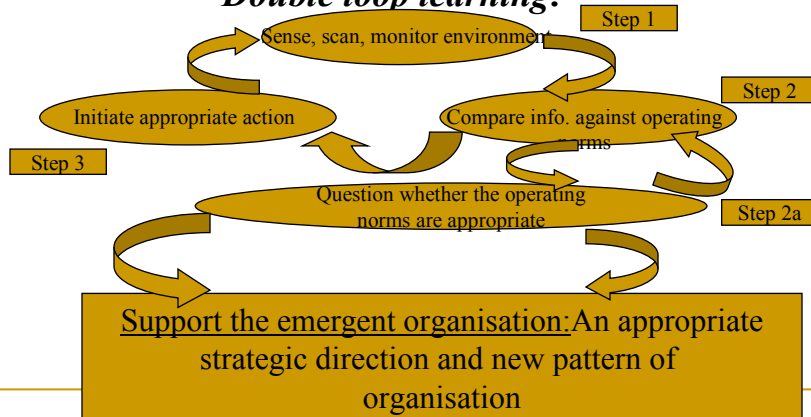Negative feedback: More leads to less, and less to more.
Who is it for?
People who are good at defensive reasoning;
People who cherish existing job descriptions, rules,
and cliques

CORPORATE LEARNING

Can organisations learn? Feedback and Control
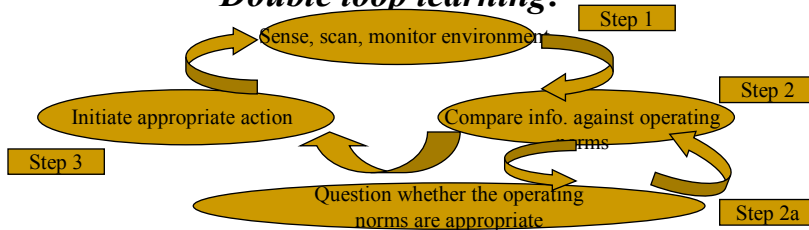### *Double loop learning:*

Sense, scan, monitor environment | Step 1

Initiate appropriate action | Compare info. against operating norms | Step 2

Step 3 | Question whether the operating norms are appropriate | Step 2a

Support the emergent organisation: An appropriate strategic direction and new pattern of organisation

CORPORATE LEARNING

Can organisations learn? Feedback and Control

Double loop learning:

Sense, scan, monitor environment — Step 1

Compare info. against operating norms — Step 2

Initiate appropriate action — Step 3

Question whether the operating norms are appropriate — Step 2a
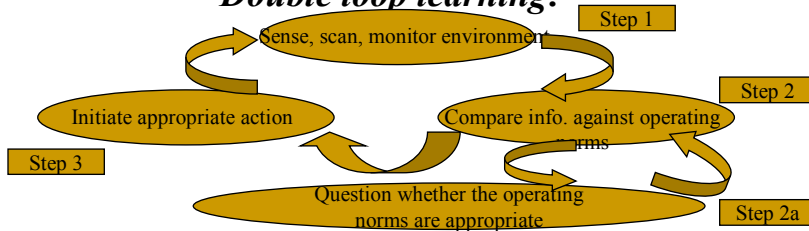
Emergent Structures

Life-long learning:
Quality Movement originated in Japan – everything has to be challenged: all norms to be examined

CORPORATE LEARNING

Can organisations learn? Feedback and Control
Double loop learning:

How can you run an organisation that is constantly changing without setting clear goals and objectives?

Cybernetics provides an answer.

Behaviour of intelligent beings is governed or guided by a sense of *vision*, adherence to *values* or *norms*. Otherwise **randomness prevails.**

CORPORATE LEARNING

Can organisations learn? Feedback and Control
Double loop learning:

Cybernetics provides an answer.

Behaviour of intelligent beings is governed or guided by a sense of *vision*, adherence to *values* or *norms*. Otherwise **randomness prevails.**

Reference points in a cybernetically controlled system that guide the behaviour of the system.

CORPORATE LEARNING

Can organisations learn? Feedback and Control

Double loop learning:

Cybernetic quality

Goals and targets reflect *noble* intentions

BUT

Achievements of goals and targets is to be moderated by an understanding of the limits that need to be placed on behaviour (→ the reference points)
And
We have problems with this open system approach

REFERENCE

Access

Information Flow

Ach rate
an ace

Recall

We have problems with this open system approach

CORPORATE LEARNING

Can organisations learn? Feedback and Control

Double loop learning:
Cybernetic quality
Keep the strategic and operational dimensions in harmony:
•**TQM 'failed' (initially): Strategic objective which required constant questioning was interrupted by single loop 'operatives' in the organisations.**
•**Continuous improvement needs a careful balance amongst what needs to be changed and at what speed.**

CORPORATE LEARNING

Can moorganisations learn? Feedback and Control

Double loop learning:
Cybernetic quality and Self organisation
•**Structures to support change;**
• **Structures that support risk taking (if your solution does not work we wont fire you)**

CORPORATE LEARNING

Can moorganisations learn? Feedback and Control

Double loop learning:

Cybernetic quality and Self organisation

- **USA: Hard/fast objectives clearly stated;**
- **Japan: Explore and understand different objectives; be prepared to change.**

CORPORATE LEARNING

Can organisations learn? Feedback and Control

Double loop learning:

Cybernetic quality

Goals and targets reflect *noble* intentions

BUT

Achievements of goals and targets is to be moderated by an understanding of the limits that need to be placed on behaviour (→ the reference points)

And

We have problems with this open system approach:
- **Distribution of power in the organisation;**
- **Loss of control and expertise during the transition from old power structures to new power structures**

CORPORATE LEARNING

1. Nature of Environment

2. Nature of task facing

3. Organisation of work

4. Nature of authority

5. Communications System

6. Nature of employee commitment

INNOVATION MANAGEMENT: CORPORATE LEARNING

Case Studies in Corporate Learning - Xerox

John Seely Brown formerly of Xerox Parc has suggested that: The research department has to do more than simply innovate new products. It must design technological and organisational 'architectures' that make a continuously innovating company possible 'coproducing' technological and organisational innovations.

INNOVATION MANAGEMENT: CORPORATE LEARNING

Case Studies in Corporate Learning - Xerox

For Seely Brown, four key-points redefine what is 'technology', 'innovation', and, indeed, research:

1. Research on new work practices is as important as research on new products
2. Innovation is everywhere; the problem is learning from it.
3. Research can't just produce innovation; it must 'coproduce' it.
4. The research department's ultimate innovation partner is the customer.

INNOVATION MANAGEMENT: CORPORATE LEARNING

Case Studies in Corporate Learning - Xerox

Document → Lens → Project→ Image → Photorecptors – (Dry Toner) → Photocopy

INNOVATION MANAGEMENT: CORPORATE LEARNING

Case Studies in Corporate Learning - Xerox

Microprocessor Control of Moving Parts → Coordination; Cheaper Memories → Collect Fault Reports & Relayed to Service Engineers

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INNOVATION MANAGEMENT: CORPORATE LEARNING

Case Studies in Corporate Learning - Xerox

Microprocessor Control of Moving Parts → Coordination;
Cheaper Memories → Collect Fault Reports & Relayed to Service Engineers.

Remote Invocation Communication (RIC) Program → Expert System

RIC Knowledge Base: Performance data for the different mechanical parts of a
photo-copier;
Rules for predicting breakdown
Inferences on the rule base and send a message to service
engineers;
Scheduling of service engineer's resources
(Maintenance fees were a large part of the revenue)

INNOVATION MANAGEMENT: CORPORATE LEARNING

Case Studies in Corporate Learning - Xerox

Photocopier → Facsimilie Production → Collating, Binding, 1→2 sides, 2→2 sides; Print time and date

A high-value, multi-functional, self-diagnostic SYSTEM

Any SYSTEM allows many-pathways of use and ABUSE.

Xerox engineers made the copier 'idiot proof' → designed the possibility of error.

Complex user manuals – written by the designers of the copiers.

INNOVATION MANAGEMENT: CORPORATE LEARNING

Case Studies in Corporate Learning - Xerox

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The DEMON copier

The user had to learn to operate a photo-copier!!!!!

20 minutes to clear paper jam.

Even for minor problems engineers were called

INNOVATION MANAGEMENT: CORPORATE LEARNING

Case Studies in Corporate Learning - Xerox

USABILITY: Xerox researchers in other departments were videoed using the machines and the result was a video-nasty
Only then the designers changed their mind.
Changed the design dramatically

INNOVATION MANAGEMENT: CORPORATE LEARNING

Case Studies in Corporate Learning - Xerox

USABILITY: Changed the design dramatically
Instead of the paper manuals we had nice GUI displays; error messages were displayed in English with extensive use of symbols.
Paper jams now take 1 minute to clear.

INNOVATION MANAGEMENT: CORPORATE LEARNING

Case Studies in Corporate Learning - Xerox

Knowledge → Abstract, concepts, reflection
→ Isolated, intellectual act →
Research is an individual act

Knowledge → Concrete, applications,
practice ➜ Collective, practical act
→ Research involves a community
of workers

INNOVATION MANAGEMENT: CORPORATE LEARNING

Case Studies in Corporate Learning - Xerox

Research ➜ Methods in hard sciences:
physics, chemistry, mathematics,
biology

Research ➜ Sciences that deal with
behaviour of the individual and
that of groups → psychology,
sociology, anthropology

INNOVATION MANAGEMENT: CORPORATE LEARNING

Learning to unlearn

www.creatingthe21stcentury.org/JSB3-learning-to-unlearn.html

Storytelling: Scientist's Perspective: John Seely Brown Learning to unlearn

The curious thing is that with these exponential changes, so much of what we currently know is just getting to be wrong. So many of our assumptions are getting to be wrong. And so, as we move forward, not only is it going to be a question of learning but it is also going to be a question of unlearning. In fact, a lot of us who are struggling in large corporations know first hand that the hardest task is to get the corporate mind to start to unlearn some of the gospels that have made them successful in the past and that no longer will actually work in the future

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INNOVATION MANAGEMENT: CORPORATE LEARNING

Case Studies in Corporate Learning - Xerox

SUPPORTING THE PERIPHERY

DISTRIBUTED COMMUNITY OF PRACTICE
• SELF DESIGNED
• EMERGENT PROTOCOLS AND NEW WORK PRACTICES
• DISTRIBUTED SOCIAL / EXPERT "MIND"

INNOVATION MANAGEMENT: CORPORATE LEARNING

Case Studies in Corporate Learning - Xerox

JSB14

INNOVATION MANAGEMENT: CORPORATE LEARNING

Case Studies in Corporate Learning - Xerox

INNOVATION MANAGEMENT: CORPORATE LEARNING
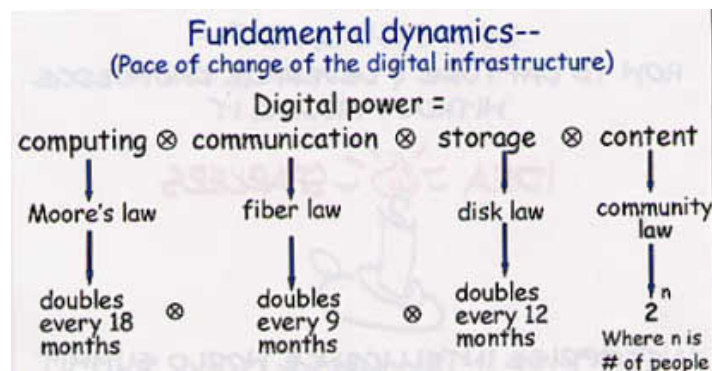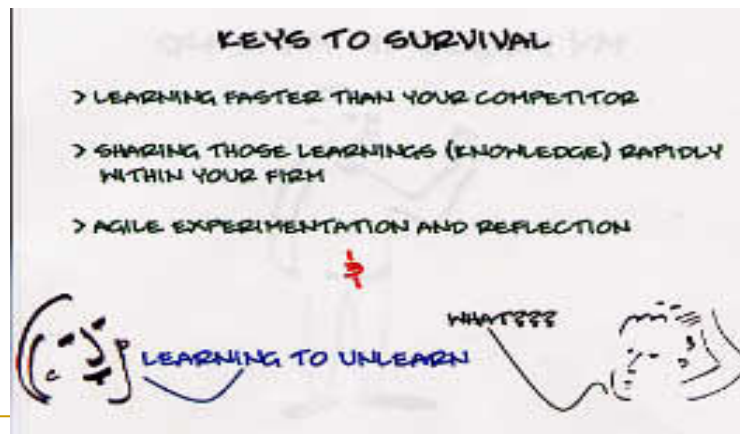
Case Studies in Corporate Learning - Xerox

INNOVATION MANAGEMENT: CORPORATE LEARNING

Case Studies in Corporate Learning - Xerox

INNOVATION MANAGEMENT: CORPORATE LEARNING

Case Studies in Corporate Learning - Xerox

NARRATIVE: An account of a series of events, facts, etc., given in order and with the establishing of connections between them; a narration, a story, an account.
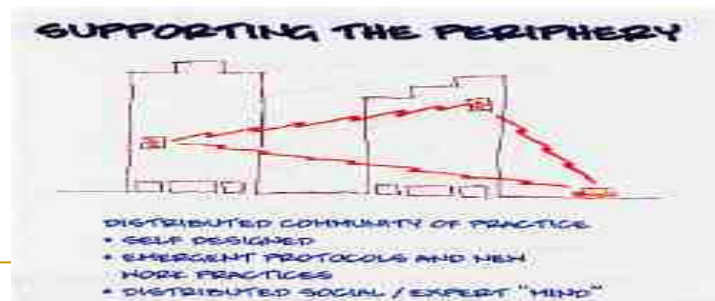

LEARNING TO USE TECHNOLOGY FROM AND WITH OTHERS...

LEARNING AND HELPING WHILE WAITING

INNOVATION MANAGEMENT: CORPORATE LEARNING

Case Studies in Corporate Learning - Xerox

ANTHROPOLOGY: The science of man, or of mankind, in the widest sense.
The science of the nature of man, embracing Human Physiology and Psychology and their mutual bearing.
The 'study of man as an animal' (Latham). The branch of the science which investigates the position of man zoologically, his 'evolution,' and history as a race of animated beings.

SUPPORTING THE PERIPHERY

DISTRIBUTED COMMUNITY OF PRACTICE
• SELF DESIGNED
• EMERGENT PROTOCOLS AND NEW WORK PRACTICES
• DISTRIBUTED SOCIAL / EXPERT "MIND"

INNOVATION MANAGEMENT: CORPORATE LEARNING

Case Studies in Corporate Learning - Xerox

Anthropology:
• The science of man, or of mankind, in the widest sense.
• The science of the nature of man, embracing Human Physiology and Psychology and their mutual bearing. The 'study of man as an animal' (Latham). The branch of the science which investigates the position of man zoologically, his 'evolution,' and history as a race of animated beings.

INNOVATION MANAGEMENT: LESSONS FROM JAPAN

Case Studies: Japanese Miracle

The Japanese model, much talked about in the early 1990's as the model of innovation and self organisation, had a number of exemplars: Canon, Honda, Sharp and NEC.
According to Professors Ikujiro Nonaka and Hirotaka Takeuchi, Hitotsubashi University (Japan), these organisations managed to change by exploiting the knowledge held within their organisations – their *core competence*- and engaged with the post-industrial society.

INNOVATION MANAGEMENT: LESSONS FROM JAPAN

Case Studies: Japanese Miracle

Professors Ikujiro Nonaka and Hirotaka Takeuchi, Hitotsubashi University (Japan) have argued that an enterprise which is thriving, has a bright future, is an enterprise which is (almost) always **creating** knowledge.

INNOVATION MANAGEMENT: LESSONS FROM JAPAN

Case Studies: Japanese Miracle

Creating new knowledge, or revising existing knowledge, requires the participation of the **KNOWLEDGE CREATION CREW** according to Nonaka and Takeuchi:

knowledge practitioners	**front line employees – researchers and team leaders in different specialisms;**
knowledge engineers	**middle managers in R&D departments**
knowledge officers	**top managers of different divisions.**

INNOVATION MANAGEMENT: LESSONS FROM JAPAN

Case Studies: Japanese Miracle

Canon succeeded by focusing on 'a small multi-feature product [copier] that could be used by anyone and produced at minimum cost'. This involved the knowledge creation crew at Canon leveraging knowledge.

INNOVATION MANAGEMENT: LESSONS FROM JAPAN

Case Studies: Japanese Miracle

With Canon's range of superb personal copiers, you can. Each model offers unique advantages in terms of size, features and functions – providing a wealth of choice when it comes to selecting your personal favourite. → **Analogue Copiers**

FC 100
The FC100 is a convenient, easy-to-use copier for either office or personal use. It provides continuous high quality copies, thanks to Canon's unique All-in-One cartridge concept.

INNOVATION MANAGEMENT: LESSONS FROM JAPAN

Case Studies: Japanese Miracle

With Canon's range of superb personal copiers, you can. Each model offers unique advantages in terms of size, features and functions – providing a wealth of choice when it comes to selecting your personal favourite. → **Analogue Copiers**

<   FC120

Easy to use and stylish, the compact FC120 has a 50-sheet bypass which handles all your copying needs effortlessly. Automatic and manual also exposure ensure a perfect finish for fine text and graphics.

< **PC890**
>

The PC890 is a top-of-the-range compact desktop personal copier that incorporates Canon's revolutionary single cartridge system and a 30-sheet automatic document feeder.

INNOVATION MANAGEMENT: LESSONS FROM JAPAN

Case Studies: Japanese Miracle

With Canon's range of superb personal copiers, you can. A digital flatbed Copier and Laser Printer in one compact unit, Canon's digital Personal Copier models deliver professional results. They give you enhanced laser output quality at up to 14 pages per minute, and require next to no maintenance. Some also include optional network printing, making them ideal fro small and larger offices alike. → DIGITAL COPIERS

PC-D320
The PC-D320 offers all the benefits of hassle-free, high quality copying, complete with the added advantage of digital efficiency. For convenient and clear copying.

The knowledge 'creation' crew at Honda started to think about *automobile evolution* during the 1980's and started to design an automobile with more room for humans and less for the machine. New knowledge was required for an automobile which was short in length and tall in height, a concept that was named *Tall Boy*.

INNOVATION MANAGEMENT: LESSONS FROM JAPAN

Case Studies: Japanese Miracle

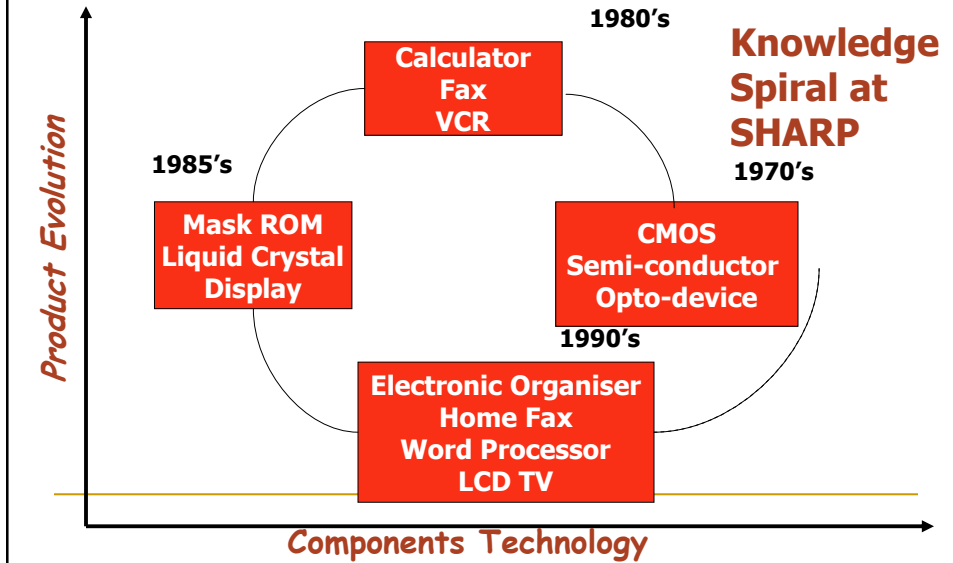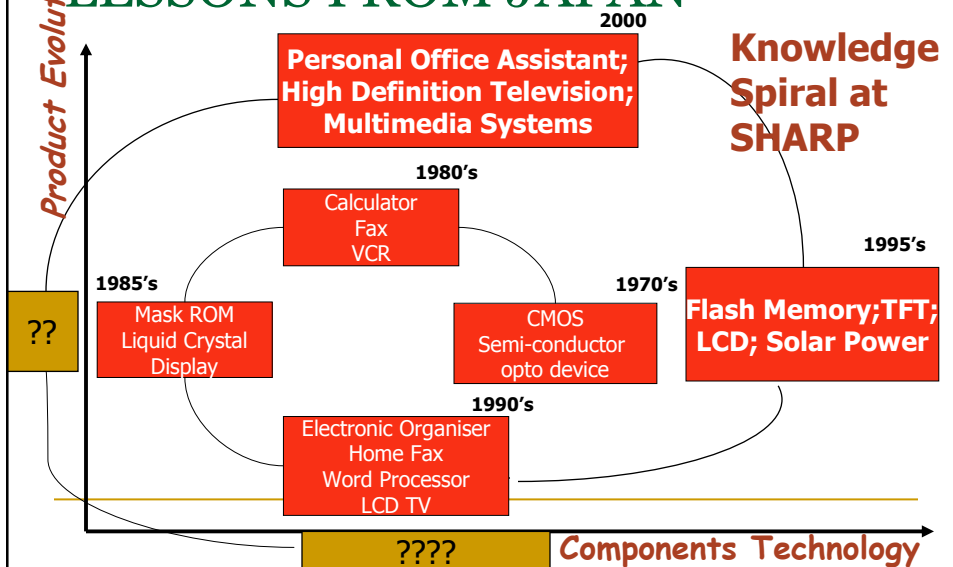| Organisation	Core Competence	New Business Areas
Canon	Imaging, optics, microprocessor controls	Copiers, laser printers, cameras, scanners
Honda	Engines, power turbines	Automobiles, motorbikes, lawn mowers, generators
NEC	VLSI, systems integration	Infotainment, office systems
Sharp	Smart white goods	Multimedia, Personal Office Assistants

INNOVATION MANAGEMENT: LESSONS FROM JAPAN

Knowledge Creation Crew:
•Is selected from different specialisms in the organisation;
•Works at different levels of organisation – undertakes research projects (PRACTITIONERS); commissions new research (ENGINEER); comments on new products (PRACTITIONERS); make executive decisions (OFFICERS)

INNOVATION MANAGEMENT: LESSONS FROM JAPAN

Product Evolution

1980's

Calculator Fax VCR

Knowledge Spiral at SHARP

1985's

1970's

Mask ROM Liquid Crystal Display

CMOS Semi-conductor Opto-device

1990's

Electronic Organiser Home Fax Word Processor LCD TV

Components Technology

INNOVATION MANAGEMENT: LESSONS FROM JAPAN

Product Evolution

2000

Personal Office Assistant; High Definition Television; Multimedia Systems

Knowledge Spiral at SHARP

1980's

Calculator Fax VCR

1995's

1985's

1970's

??

Mask ROM Liquid Crystal Display

CMOS Semi-conductor opto device

Flash Memory;TFT; LCD; Solar Power

1990's

Electronic Organiser Home Fax Word Processor LCD TV

????

Components Technology

Knowledge Spiral and Innovation

Products/Services

Scientific Progress & Technical Change

Social Attitudes
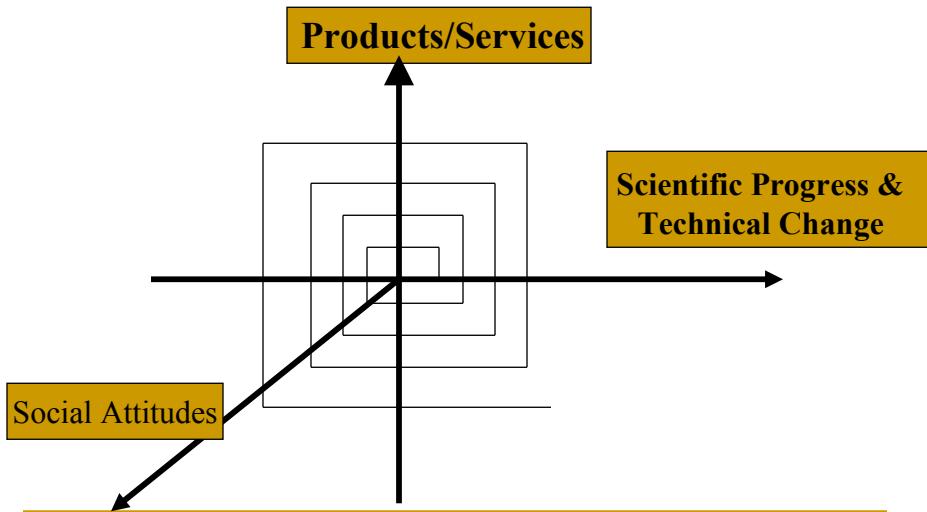
Corporate Learning
KNOWLEDGE WORK & SOCIETY

Officer

Engineer

Practitioner

Leveraged Knowledge

Document DB

'Artefact' DB
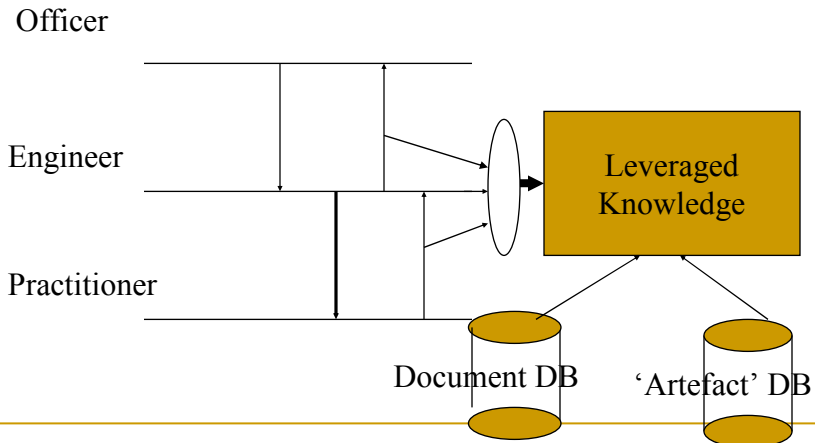
A MODEL FOR INNOVATION MANAGEMENT

•Is their any way, managerial or technological, by which the processes and mechanisms that facilitate the permeation of knowledge be harnessed ?

•Harnessing knowledge sometimes could mean responding to or precipitating changes in markets, fashions, belief and values.

•And, at other times harnessing knowledge may help in a campaign or struggle to contravene the belief and values of the individuals or other organisations

A MODEL FOR INNOVATION MANAGEMENT

•The key question is how the knowledge of an individual or a group of individuals impacts on an organisation?

•There are a number of models in the knowledge management literature that help us to understand some of the ways in which how individuals or groups impact organisation (Seung et al 1999). Most of these models are based on a life-cycle analogy:

Creation – Growth –Maturity – Utility – Death

We will be studying one of these models due to Nonaka and Takeuchi.

A MODEL FOR INNOVATION MANAGEMENT

Two dimensions of knowledge creation in organisation: explicit and tacit knowledge

Explicit Knowledge (OBJECTIVE)	Knowledge of rationality (**mind**); Sequential knowledge (**there and then**); Digital knowledge (**theory**).
Tacit Knowledge (SUBJECTIVE)	Knowledge of experience (**skills**); Simultaneous knowledge (**here and now**); Analog knowledge (**practice**).

A MODEL FOR INNOVATION MANAGEMENT

Two dimensions of knowledge creation in organisation: explicit and tacit knowledge

The transmission of knowledge in an organisation?

Before transmission starts, you must understand what you are transmitting and how will it be received.

•Do I have the knowledge which will benefit others or the organisation? (Ontological question)

•Is my knowledge in a suitable form to be transmitted or received? (Epistemological question)

A MODEL FOR INNOVATION MANAGEMENT

Dimensions of knowledge creation in an organisation

Dimension	Type
Explicit	Symbolic
Implicit	Embodied
Implicit/Tacit	Ingrained
Tacit	Culturally acquired

A MODEL FOR INNOVATION MANAGEMENT

Two dimensions of knowledge creation in organisation: explicit and tacit knowledge

Explicit Knowledge (OBJECTIVE)	Articulated mainly as texts that use special languages of science and technology; Knowledge which is largely formalized, consensual and public; Knowledge available in informative texts, e.g., learned journals, technical reports and advanced textbooks, and in instructive texts, for instance, manuals, instruction leaflets.
Tacit Knowledge (SUBJECTIVE)	Articulated usually through speech using the special languages but suffused with metaphors, analogies and similes; Knowledge which is largely informal, idiosyncratic and private; Statements, annual reports, inter-office memos, advertisements, product catalogues

A MODEL FOR INNOVATION MANAGEMENT

Invention: Many paths available

Computing Technology: Choice between digital and analog;

Chosen Technology: Digitial → Sequential and Parallel

Chosen Technology: Sequential →Silicon vs Germanium

Chosen Technology: Silicon

A MODEL FOR INNOVATION MANAGEMENT

Nonaka & Takeuchi's Knowledge Conversion Modes

	Tacit Knowledge	Explicit Knowledge
	To	
Tacit Knowledge	**Socialisation** Sympathised Knowledge	**Externalisation** Conceptual Knowledge
From		
Explicit Knowledge	**Internalization** Operational Knowledge	**Combination** Systemic Knowledge
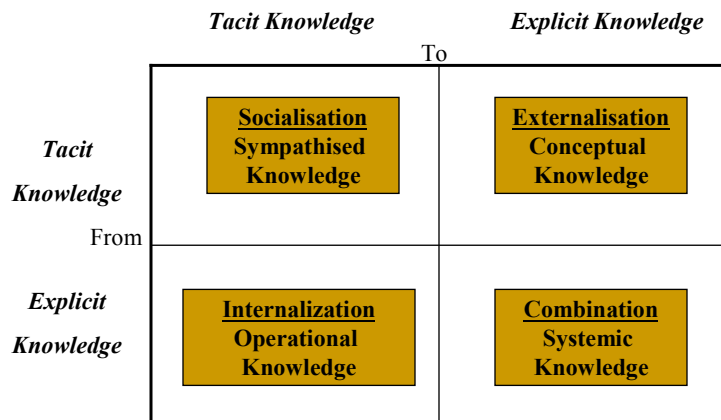
A MODEL FOR INNOVATION MANAGEMENT

Nonaka & Takeuchi's Knowledge Conversion Modes

Field Building

When workers within and across disciplinary boundaries interact with each other:

• the workers build a **field of interaction**; the field facilitates the sharing of each others experience and their views about the organisation they work in –products, services, vision;

• the workers engage in a **dialogue**

• the workers translate an external situation into an internal model or simulation of the world;

• the workers build **a mental model and share the model**

A MODEL FOR INNOVATION MANAGEMENT

Nonaka & Takeuchi's Knowledge Conversion Modes

Dialogue

When workers within and across disciplinary boundaries interact with each other:

• **the workers engage in a dialogue**

• **the workers share knowledge by using partial similarities between their rather different backgrounds → analogies**

   • **Horse is to zebra as dog is to -------?**

• **the workers also carry over knowledge from one domain to another → metaphors (from the Greek meaning 'to carry over)**

   • **atomic system is like the planetary system**

A MODEL FOR INNOVATION MANAGEMENT

Nonaka & Takeuchi's Knowledge Conversion Modes

Linking Explicit Knowledge

When workers within and across disciplinary boundaries interact with each other:
- **the workers engage in using analogies and metaphors**
- **the workers start linking knowledge which has been articulated and knowledge which they have created → networking;**
- **the workers start creating new products and services**

A MODEL FOR INNOVATION MANAGEMENT

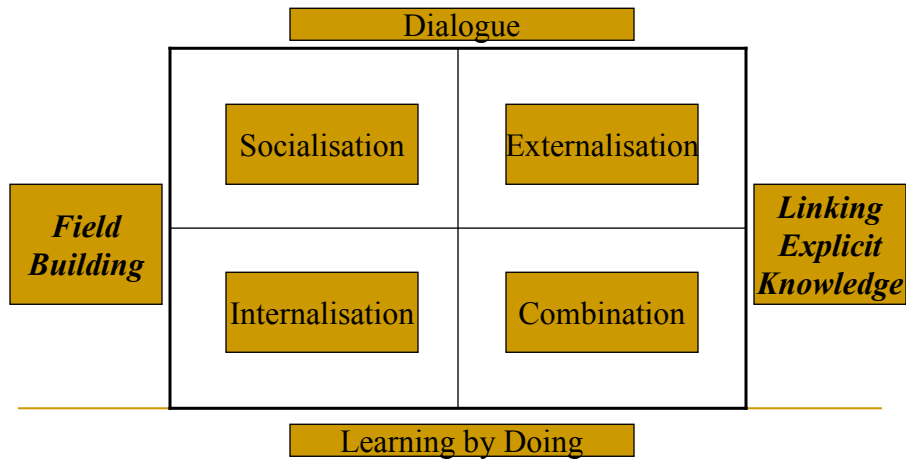## *Nonaka & Takeuchi's Knowledge Conversion Modes*

Learning by doing

When workers within and across disciplinary boundaries interact with each other:
- **the workers start linking knowledge which has been articulated and knowledge which they have created → networking;**
- **the workers start learning from doing and constructing their implicit knowledge to face the new situation**
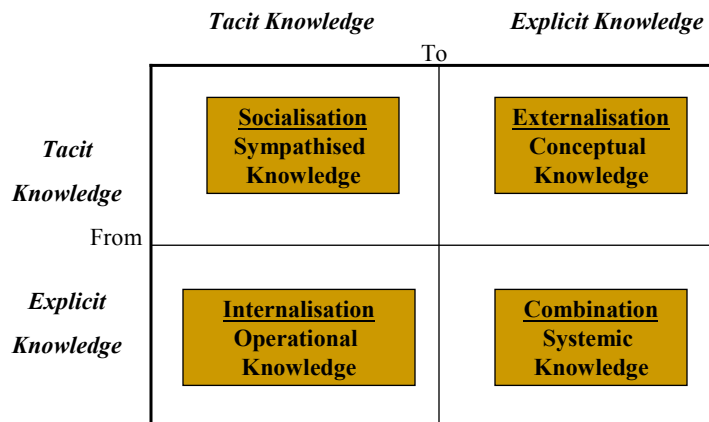
A MODEL FOR INNOVATION MANAGEMENT

Nonaka & Takeuchi's Knowledge Conversion Modes

Dialogue

	Socialisation	Externalisation	
Field Building	Internalisation	Combination	Linking Explicit Knowledge

Learning by Doing

A MODEL FOR INNOVATION MANAGEMENT

Nonaka & Takeuchi's Knowledge Conversion Modes

	Tacit Knowledge	Explicit Knowledge
	To	
Tacit Knowledge (From)	**Socialisation** Sympathised Knowledge	**Externalisation** Conceptual Knowledge
Explicit Knowledge	**Internalisation** Operational Knowledge	**Combination** Systemic Knowledge

A MODEL FOR INNOVATION MANAGEMENT

Dialogue

Socialization   Externalisation

Linking Explicit Knowledge

Field Building

Internalisation   Combination

Learning by doing
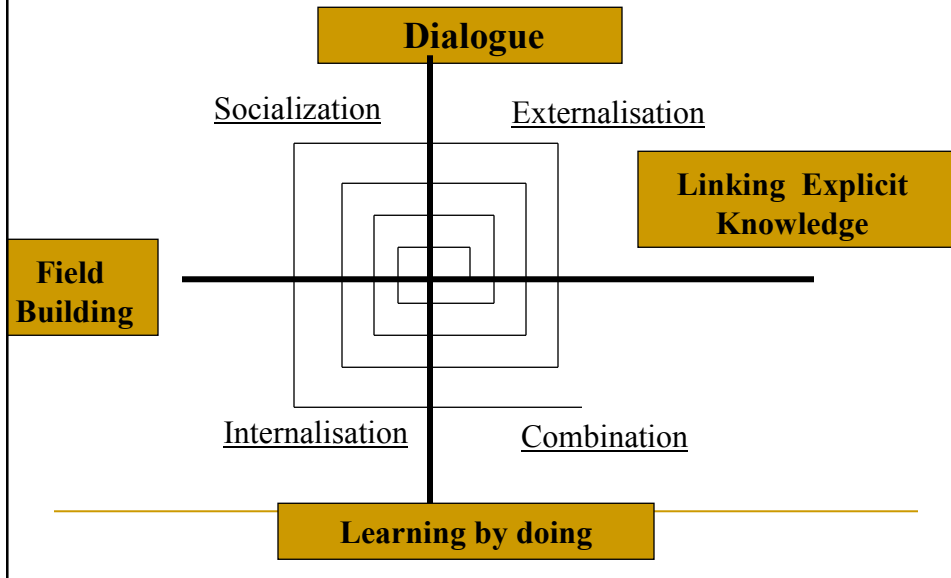
A MODEL FOR INNOVATION MANAGEMENT

Knowledge creation in organisations – A conveyer belt with external links?

Sharing tacit knowledge   Creating concepts   Justifying concepts   Building archetypes   Cross Levelling Knowledge

A MODEL FOR INNOVATION MANAGEMENT

Customers & Performers and Knowledge Transformation

	Performers	Customers
Performers	Socialisation	Externalisation
Customers	Internalisation	Combination

A MODEL FOR INNOVATION MANAGEMENT

Knowledge creation in organisations- A 5 Phase Model

Phase	Requirement
Sharing Tacit Knowledge	Self-organizing team; Creative chaos injected by the management
Creating Concepts	Autonomy for the workers; Fluctuation and chaos may help
Justifying Concepts	Top management to formulate justification criteria; Redundancy of information.
Building an Archetype	Dynamic co-operation across organisations and amongst workers.
Cross-levelling knowledge	Intra-organizationally: autonomy; chaos. Inter-organizationally: dynamic interaction.

A MODEL FOR INNOVATION MANAGEMENT

Combination Knowledge:

Two disparate, very different and apparently sharing nothing in common technologies or sciences when put together lead to an entirely new technology/science.

Biology + Chemistry Biology + Physics	Biochemistry; Biophysics; Molecular Biology
Thermodynamics+ Rotary/Linear Motion	Automobile technology;
Computing + Communications	Information Technology

A MODEL FOR INNOVATION MANAGEMENT

Modern Management: Distinguishes between management and ownership → Asset/Labour Management.

Post-industrial society: Distinguishes between the ownership of knowledge and the management of knowledge

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A MODEL FOR INNOVATION MANAGEMENT

Nonaka & Takeuchi's *Knowledge Conversion Modes*

Process	Task	Methods/Techniques
Socialisation Tacit → Tacit	Share experience; Transfer skills; Explain models	Brain storming; suggestion boxes; best employees
ExternalisationTacit → Explicit	Articulate knowledge; concepts, hypotheses	Dialogue; collective reflection
InternalisationExplicit → Tacit	Transfer/acquire knowledge: by 'doing'; by teaching; project work	Experience documentation; oral stories
Combination Explicit → Explicit	Systematise knowledge; Evaluation; Testing	Document Management; creating, revising, archiving and pruning learned papers, technical reports, design documents

A MODEL FOR INNOVATION MANAGEMENT

Knowledge Creation Crew: Practitioners

Practitioner Type	Task	Focus	Exemplars
Operators	Gather & accumulate knowledge	Tacit Knowledge	Auto-test drivers, Sales Force, Technicians
Specialists	Gather, accumulate & create knowledge	Explicit Knowledge	R&D scientists, software/design engineers, planners, market researchers

A MODEL FOR INNOVATION MANAGEMENT

Knowledge Creation Crew: Engineers

Engineer Type	Task	Focus	Exemplars
Middle Managers/ Consultants	Convert knowledge (explicit↔ tacit), synthesise	Explicit/ Implicit	Innovators; Facilitator

A MODEL FOR INNOVATION MANAGEMENT

Knowledge Creation Crew: Officer

Officer Type	Task	Focus	Exemplars
Top-line managers/ Investors	Create knowledge; envision	Explicit	CEOs, Venture Capitalists