Whom, when + where do *Systems Changes* situate?

Value(s), services, and socio-technical affirming phronesis

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Agenda

[preamble] Episteme, Techne, Phronesis (reordered)

- Intellectual Pursuits (Rethinking Systems Thinking)
- Systems changes as situated c.f. ideal-seeking

A. Value(s), Judgment, Soft Systems Thinking

- Appreciative Systems (Vickers, Checkland)
- Policy, impacts and consequences of systems changes

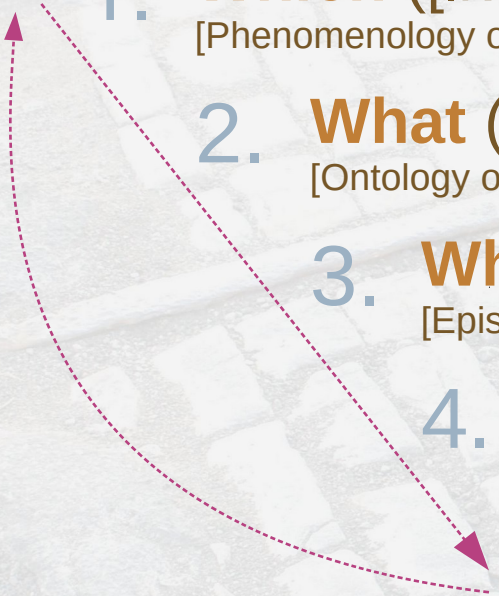
B. Service Systems (c.f. Production Systems)

- Science of Service Systems (Spohrer, Kijima)
- Material-products c.f. information-services as systems changes

C. Socio-Technical Systems Perspective

- Tavistock Institute + Legacy (Trist, Emery, Ramirez)
- Coproduction and design principles guiding systems changes

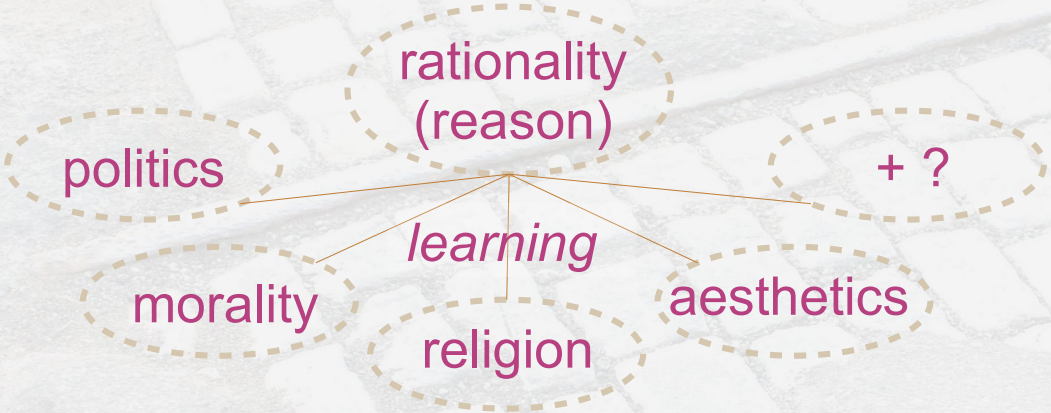
A 5-Question Cycle for Systems Changes can guide modes of inquiry grounded on five philosophical traditions



1. **Which** ([living] wholes, containing wholes, parts)?
   [Phenomenology of joint attention on systems changes]
2. **What** (affordances, capacities, taskscapes-landscapes)?
   [Ontology of becoming with systems changes]
3. **Why** (causes)?
   [Episteme of systems changes]
4. **Whom**, **when**, **where** (impacts)?
   [Phronesis in systems changes]
5. **How** (collective action)?
   [Techne for systems changes]

An authentic *Systems Approach* engages its *enemies*

… the ***systems approach*** belongs to a whole class of approaches to managing and planning our human affairs with the intent that we as a living species conduct ourselves properly in this world. [p. 7]



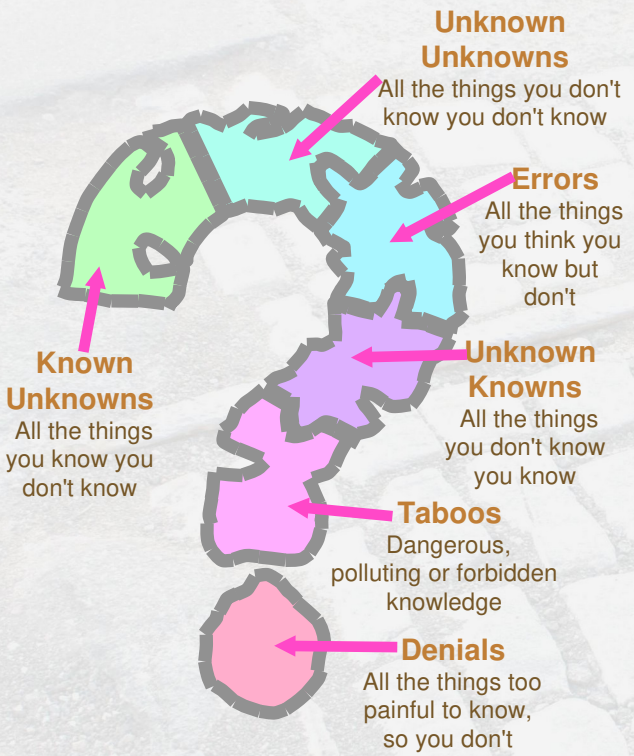
Common to all these enemies is that none of them accepts the reality of the "whole system": we do not exist in such a system. Furthermore, in the case of **morality**, **religion**, and **aesthetics**, at least a part of our reality as human is not "in" any system, and yet it plays a central role in our lives.

To me these enemies provide a powerful way of learning about the systems approach, precisely because they enable the rational mind to step outside itself and to observe itself (from the vantage point of the enemies). [….]

We must face the reality that the enemies offer: what's really happening in the human world is **politics**, or **morality**, or **religion**, or **aesthetics**. This confrontation with reality is totally different from the rational approach, because the reality of the enemies cannot be conceptualized, approximated, or measured (pp. 24–53).

Source: Churchman, C. West. 1979. *The Systems Approach and Its Enemies*. New York: Basic Books.

With known knowns in science eroding by systemic world changes, collective learning on why, how + when-where-whom gains value



Colloquial description:	**Learning why**	**Learning how**	**Learning when, learning where, learning whom**
Pursuits:	Uncovering universal truths	Instrumental rationality towards a conscious goal	Values in practice based on judgement and experience
Primary intellectual virtue:	**Episteme**	**Techne**	**Phronesis**
Translation / interpretation:	Science (viz. epistemology)	Craft (viz. technique)	Prudence, common sense
Type of virtue:	Analytic scientific knowledge	Technical knowledge	Practical ethics
Orientation:	Research	Production	Action
Nature:	Universal	Pragmatic	Pragmatic
	Invariable (in time and space)	Variable (in time and space)	Variable (in time and space)
	Context-independent	Context-dependent	Context-dependent

[1] Ing, David, Minna Takala, and Ian Simmonds. 2003. "Anticipating Organizational Competences for Development through the Disclosing of Ignorance." In *Proceedings of the 47th Annual Meeting of the International Society for the System Sciences*. Hersonissos, Crete. http://systemicbusiness.org/pubs/2003_ISSS_47th_Ing_Takala_Simmonds.html

[2] Ing, David. 2013. "Rethinking Systems Thinking: Learning and Coevolving with the World." *Systems Research and Behavioral Science* 30 (5): 527–47. doi:10.1002/sres.2229.

The last glacial cycle of δ18O (an indicator of temperature) and selected events in human history. The Holocene is the last 10000 years.

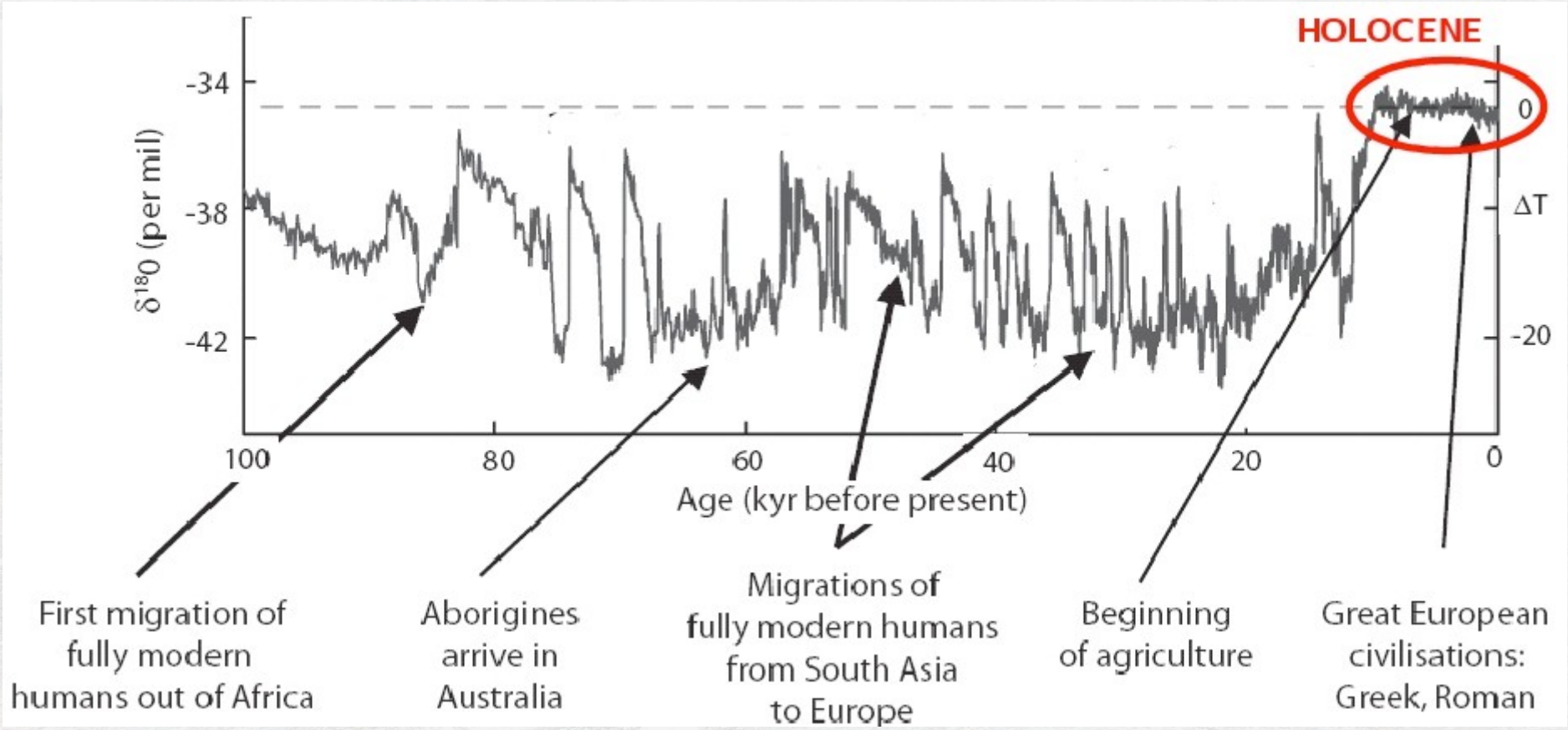


Figure 1 (adapted from Young and Steffen (2009), Rockström, J., W. Steffen, K. Noone et al. 2009. "Planetary Boundaries: Exploring the Safe Operating Space for Humanity." *Ecology and Society* 14 (2): 32. http://www.ecologyandsociety.org/vol14/iss2/art32/ .

Planetary boundaries by 2009 had been crossed (rows in red)

Earth-system process	Parameters	Proposed boundary	Current status	Pre-industrial value
Climate change	(I) Atmospheric carbon dioxide concentration (parts per million by volume) (ii) Change in radiative forcing (watts per metre squared)	350 1	387 1.5	280 0
Rate of biodiversity loss	Extinction rate (number of species per million species per year)	10	>100	0.1-1
Nitrogen cycle (part of a boundary with the phosphorus cycle)	Amount of N_2 removed from the atmosphere for human use (millions of tonnes per year)	35	121	0
Phosphorus cycle (part of a boundary with the nitrogen cycle)	Quantity of P flowing into the ocean (millions of tonnes per year)	11	8.5 - 9.5	-1
Stratospheric ozone depletion	Concentration of ozone (Dobson unit)	276	283	290
Ocean acidification	Global mean saturation state of aragonite in surface sea water	2.75	2.90	3.44
Global freshwater use	Consumption of freshwater by humans (km^3 per year)	4,000	2,600	415
Change in land use	Percentage of global land cover converted to cropland	15	11.7	Low
Atmospheric aerosol loading	Overall particulate concentration in the atmosphere, on a regional basis		To be determined	
Chemical pollution	For example, amount emitted to, or concentration of persistent organic pollutants, plastics, endocrine disrupters, heavy metals and nuclear waste, in the global environment, or the effects on ecosystem and functioning of Earth system thereof		To be determined	

Table 1, Rockström, J., W. Steffen, K. Noone et al. 2009. “Planetary Boundaries: Exploring the Safe Operating Space for Humanity.” *Ecology and Society* 14 (2): 32. http://www.ecologyandsociety.org/vol14/iss2/art32/.

By 2009, the earth had exceed three planetary boundaries

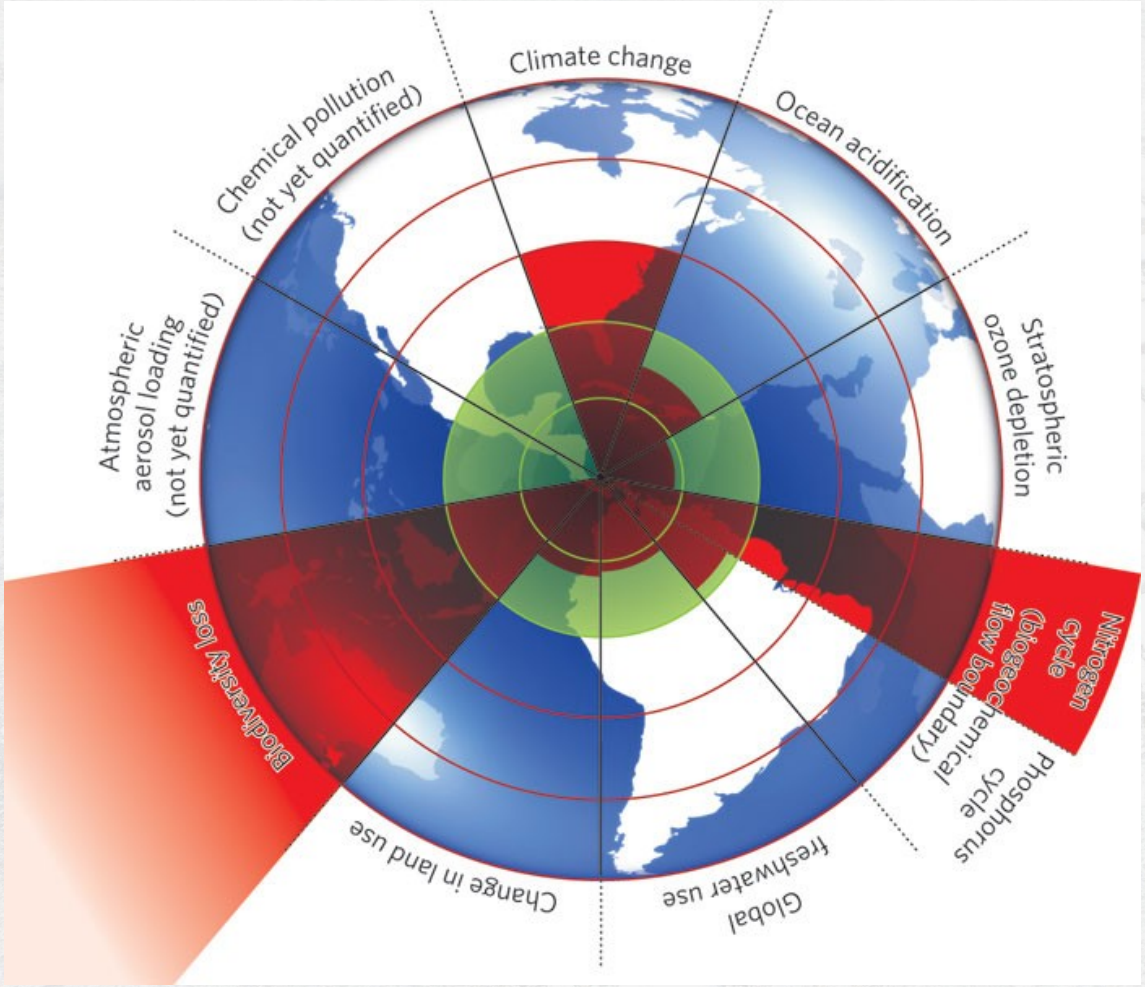


Figure 1.

The inner green shading represents the proposed safe operating space for nine planetary systems.

The red wedges represent an estimate of the current position for each variable.

The boundaries in three areas (rate of biodiversity loss, climate change and human interference with the nitrogen cycle), have already been exceeded.

Rockström, Johan, Will Steffen, Kevin Noone, et al. 2009.
"A Safe Operating Space for Humanity."
Nature 461 (7263): 472–475.
http://dx.doi.org/10.1038/461472a. .

In transdisciplinary work, systems changes may see scientific narratives as more robust than models

In a **[scientific] narrative**, a **series of dynamic happenings** are transformed into **rate-independent events**.

Narratives in science are not about the verity of facts, but are explicitly about **what the narrator considers important**.
The storyteller says which part of the infinitely rich dynamics of full material change is worthy of becoming a named event. Narratives are ordered according to the preferences of the narrator, and account for experience and relationships in explicitly subjective terms.

Narratives help us **make up our minds**.
Context gives meaning. An earlier part of the story can create a context for a later part of the story, thus changing the meaning of that latter part from what it would have been in isolation. In this way, narrative tracks events as they unfold, and so reflect a process of the world becoming.

Narrative gives a **point of view**.
In narratives, there is often tension between the focal attention at a point in the story and the tacit attention of the context to that point ...

Narratives need not be internally consistent, in the way that models should be.
This makes narratives more robust than models, because they are still in business when things change to the point of contradiction.

In scientific narrative, there may be multiple causalities, without the narrative failing.
The power of narratives is in their ability to make experience commensurate for those who tell and hear the tale. Narratives do this by working on how the various parties feel about the issue at hand.

Allen, Timothy F. H., and Mario Giampietro. 2006. "Narratives and Transdisciplines for a Post-Industrial World." *Systems Research and Behavioral Science* 23 (5): 595–615. https://doi.org/10.1002/sres.792.

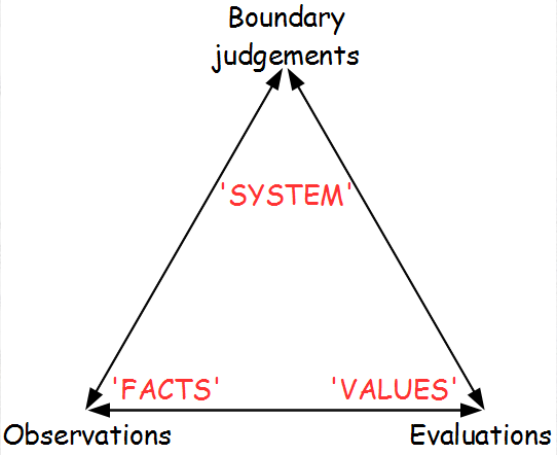
Voices that are heard (or not heard) is the concern of critical systems heuristics, with observations and evaluations considered relevant or not

Boundary conditions	Boundary issues
1. Client 2. Purpose 3. Measure of improvement	Sources of motivation
4. Decision-maker 5. Resources 6. Decision environment	Sources of power
7. Professional 8. Expertise 9. Guarantee	Sources of knowledge
10. Witness 11. Emancipation 12. World view	Sources of legitimation

Those involved

Those affected

The reference system (system of concern) that determines what observations ("facts") and evaluations ("values") are considered relevant when it comes to assessing the merits or defects of a proposition.



Ulrich, Werner. 2000. "Reflective Practice in the Civil Society: The Contribution of Critically Systemic Thinking." *Reflective Practice: International and Multidisciplinary Perspectives* 1 (2): 247. https://doi.org/10.1080/713693151.

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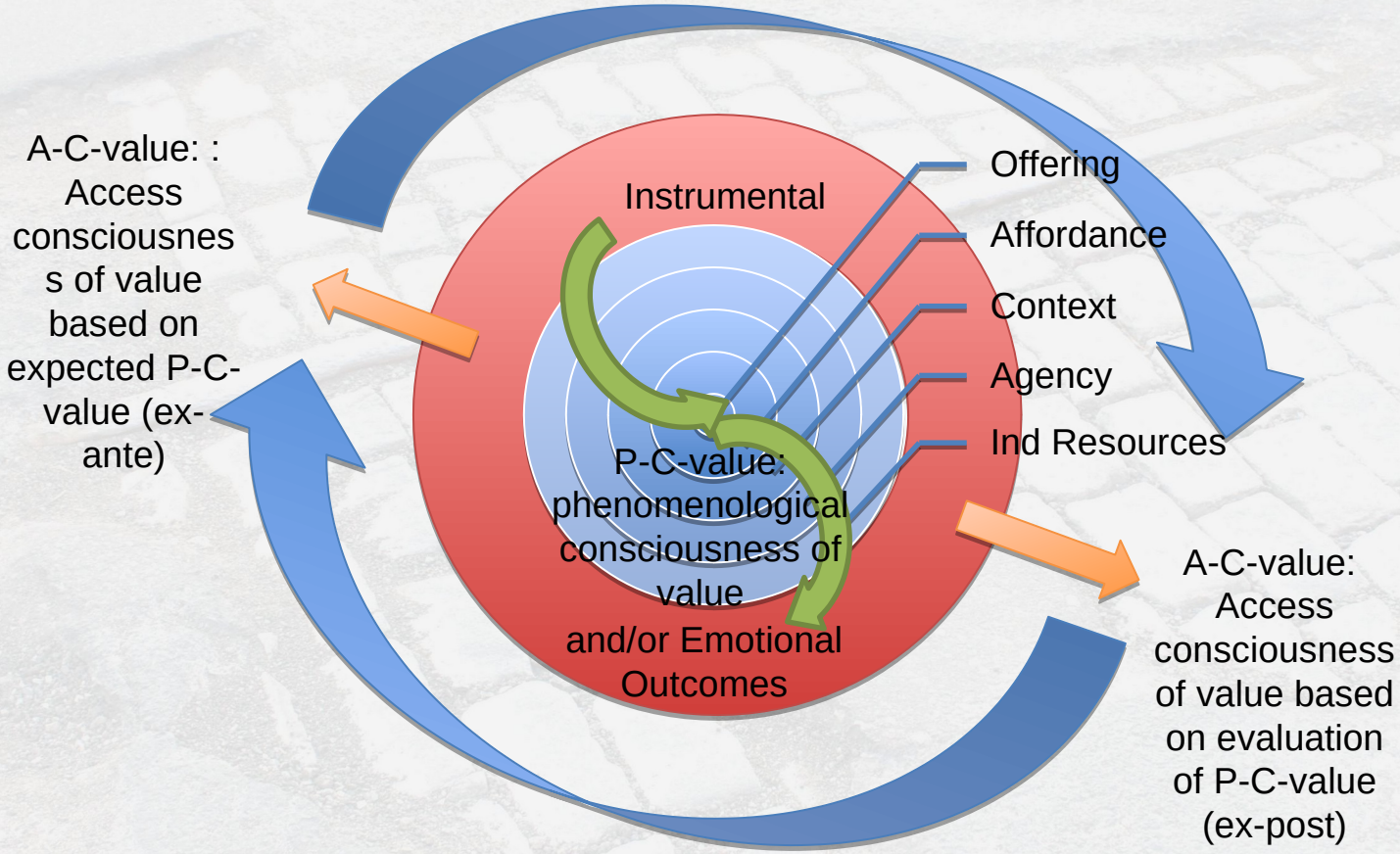
Value is dynamic, with access consciousness ex-ante and ex-post, and phenomenological consciousness in lived experience



Irene C.L.,Ng and Laura A. Smith. 2012. "An Integrative Framework of Value." In *Toward a Better Understanding of the Role of Value in Markets and Marketing*, 9:207–43. *Review of Marketing Research* 9. Emerald Group Publishing Limited. http://dx.doi.org/10.1108/S1548-6435(2012)0000009011
.

Values in purposeful systems espouse pursuit of 3 ancient Greek transcendental ideals of truth, beauty and goodness, plus a meta-ideal of plenty

Ancient Greek philosophers identified the **four primary aspects of development**: **truth**, **plenty**, the **good**, and **beauty/fun**. Each aspect is necessary, but only when the four are taken together are they sufficient for continuous development.

Truth.
The pursuit of **truth** is the function of **science**.
Science produces information, knowledge, and understanding. Technology is the application of the products of science, and education is the principal means by which the outputs of science and technology are disseminated. Together, science, technology, and education enable people to pursue their ends more efficiently. They provide the *means* with which we pursue our ends and they try to improve these means continuously.

Plenty.
The pursuit of **plenty** is the function of the economy, which is concerned with (1) **producing and distributing the *resources*** that make possible the pursuit of *ends* with the most efficient means available (the role of business and government); and (2) **protecting the resources** acquired against their appropriation, theft, or destruction by others or nature (the role of the justice system, the health system, the environmental protection agency, the military, and insurance).

The Good.
The **pursuit of the good** involves the dissemination of **ethical and moral principles**.
This is carried out primarily by religious and educational institutions, and more recently by psychiatry. It entails promoting cooperation to enable the attainment of objectives that would otherwise not be attained. This, in turn, requires eliminating conflict within individuals (peace of mind) and between individuals (peace on Earth) because conflict limits the number of objectives that can be attained or the number of people who can attain them. Therefore, ethics enables identification of the *ends* whose pursuit leads to development.

Beauty/Fun.
The pursuits of **beauty and fun** – the products of creative and recreative activities – are inseparable aspects of **aesthetics**.
Together they make possible the continuous pursuit of any ideal, including omnicompetence, and hence development, by providing the push and pull necessary for such pursuit.

Ackoff, Russell Lincoln. 1999. *Re-Creating the Corporation: A Design of Organizations for the 21st Century*. Oxford University Press.

Human affairs are characterized an appreciative circular process of systemic inquiring through (i) perceiving, (ii) judging and (iii) acting

… we can highlight some major recurring themes in Vickers' thinking.

- a rich concept of day-to-day experienced **life** … as a **flux of interacting events and ideas**;
- a separation of judgements about what is the case, '**reality judgements**', and judgements about what is humanly good or bad, '**value judgements**';
- an insistence on '**relationship maintaining**' as a richer concept of human action than the popular but poverty-stricken notion of goal seeking;
- a concept of **action judgements** stemming from reality and value judgements;
- a notion that the **cycle of judgements and actions** are **organised as a system**

Vickers' work was thus part of the 'soft systems' approach with the systems movement, but was carried out independently.
… **Soft Systems Methodology**, a systemic inquiry process [is] **an operationalisation** of the process Vickers calls '**appreciation**'.

Checkland, Peter B., and Alejandro Cesar. 1986. "Vickers' Concept of an Appreciative System: A Systemic Account." *Journal of Applied Systems Analysis* 13 (3): 3–17.

Appreciation is modeled as an abstract entity with arrows as ‘leads to’, with only the system as a whole enacting appreciation as a social process

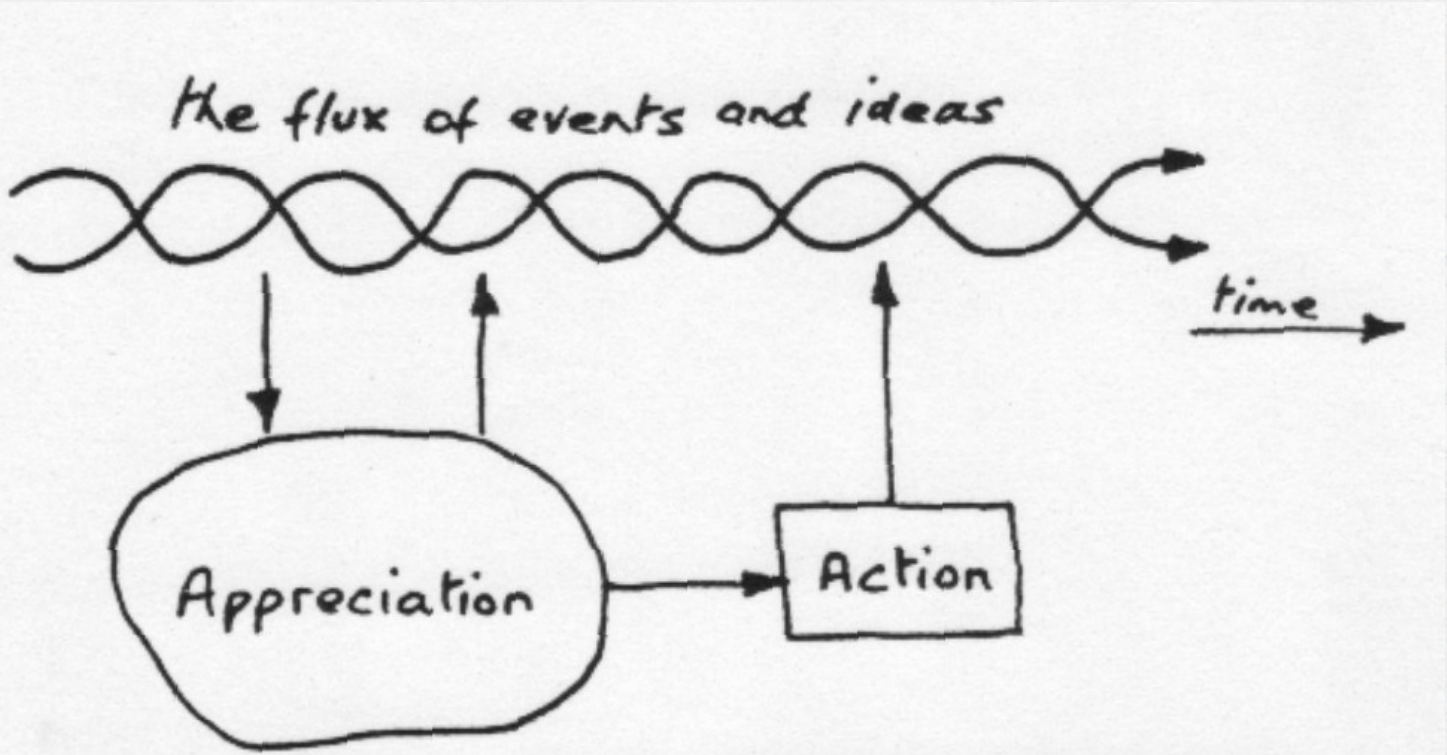


FIGURE 1: The general structure of an appreciative system

The starting point … is ... the interacting flux of events and ideas unfolding over time. […]

Appreciation perceives (some of) reality, makes judgement about it, contributes to the idea stream, and leads to actions which become part of the events stream. […]

There is a recursive loop in which the flux of events and ideas generate appreication, while appreciation itself contributes to the flux.

Appreciation also leads to action which itself contributes to the flux.

Checkland, Peter B., and Alejandro Cesar. 1986. “Vickers’ Concept of an Appreciative System: A Systemic Account.” *Journal of Applied Systems Analysis* 13 (3): 3–17.

Judgments are in processes of maintaining or modifying standards of (i) fact, and (ii) value, rather than goal seeking (towards an ideal)

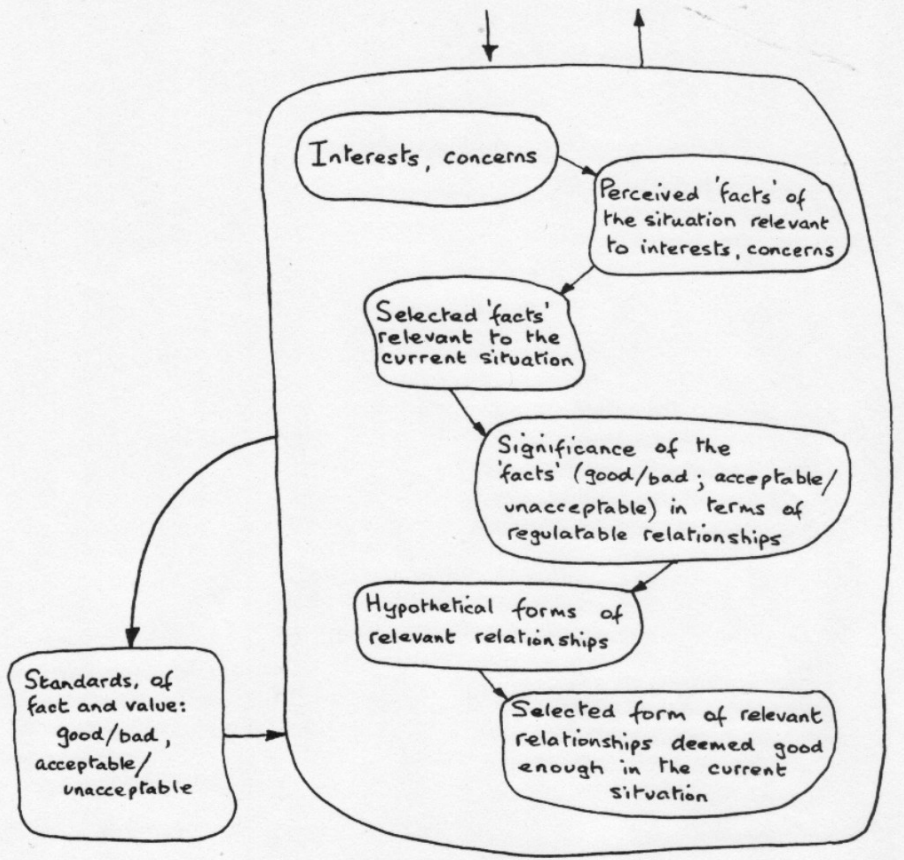


FIGURE 2: The process of appreciation

… we take the notion of perceiving 'reality' selectively and making judgements about it.

The epistemology of the judgement-making will be one of relationship-managing rather than goal-seeking.

And **both reality and value judgements** stem from **standards of both fact and value**:

- standards of **what *is***, and
- standards of **what is good or bad**, acceptable or unacceptable.

The very act of using the standards may itself modify them.

The activities of Figure 2 lead to a decision of how to **act** to **maintain**, **modify** or **elude** certain forms of relevant relationships.

Checkland, Peter B., and Alejandro Cesar. 1986. "Vickers' Concept of an Appreciative System: A Systemic Account." *Journal of Applied Systems Analysis* 13 (3): 3–17.

Appreciation of the standards leads to decisions and action, that may change the standard from the prior states in history of the system

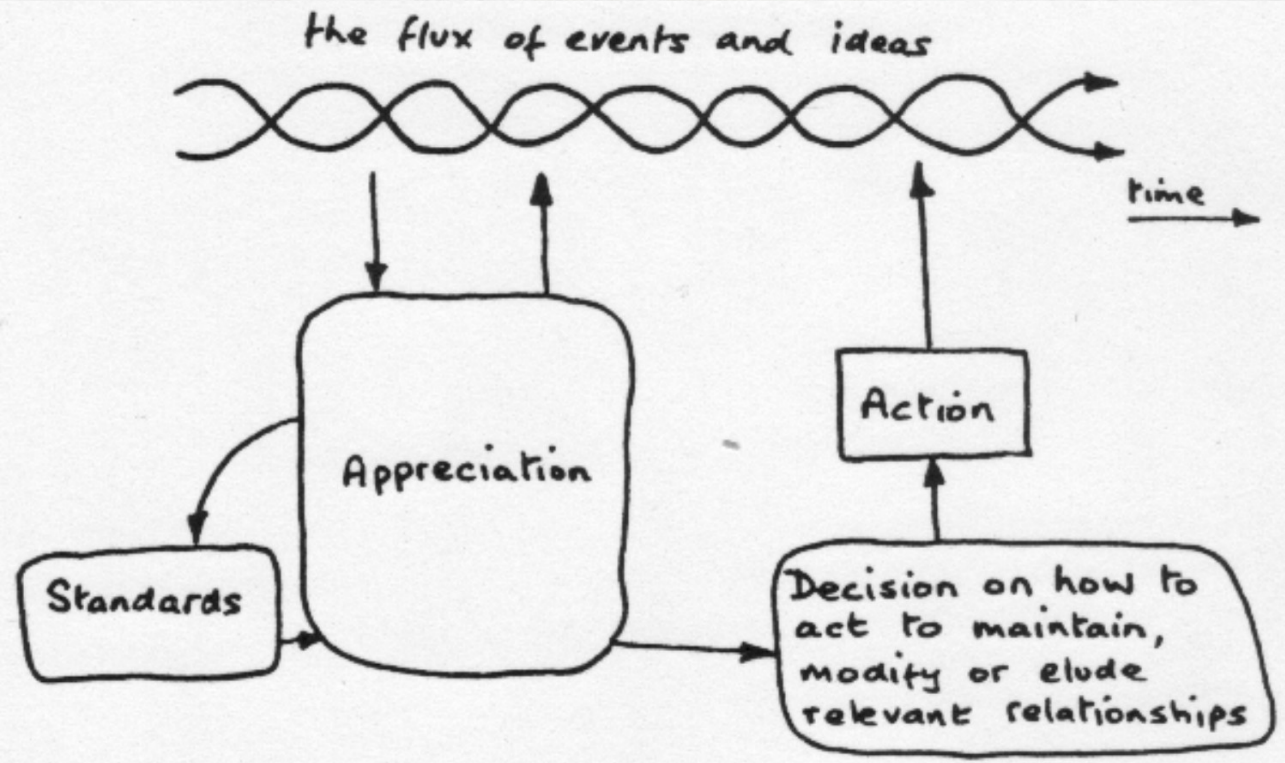


FIGURE 3: Appreciation leading to action

… Vickers' most important point [is] that the **source of the standards** is the ***previous history of the system itself***.

In addition, the present operation of the **system** may modify its present and future operation through its **effect on the standards**.

Checkland, Peter B., and Alejandro Cesar. 1986. "Vickers' Concept of an Appreciative System: A Systemic Account." *Journal of Applied Systems Analysis* 13 (3): 3–17.

Appreciation is a dynamic open system, where standards from a previous cycle may or may not change for a subsequent cycle

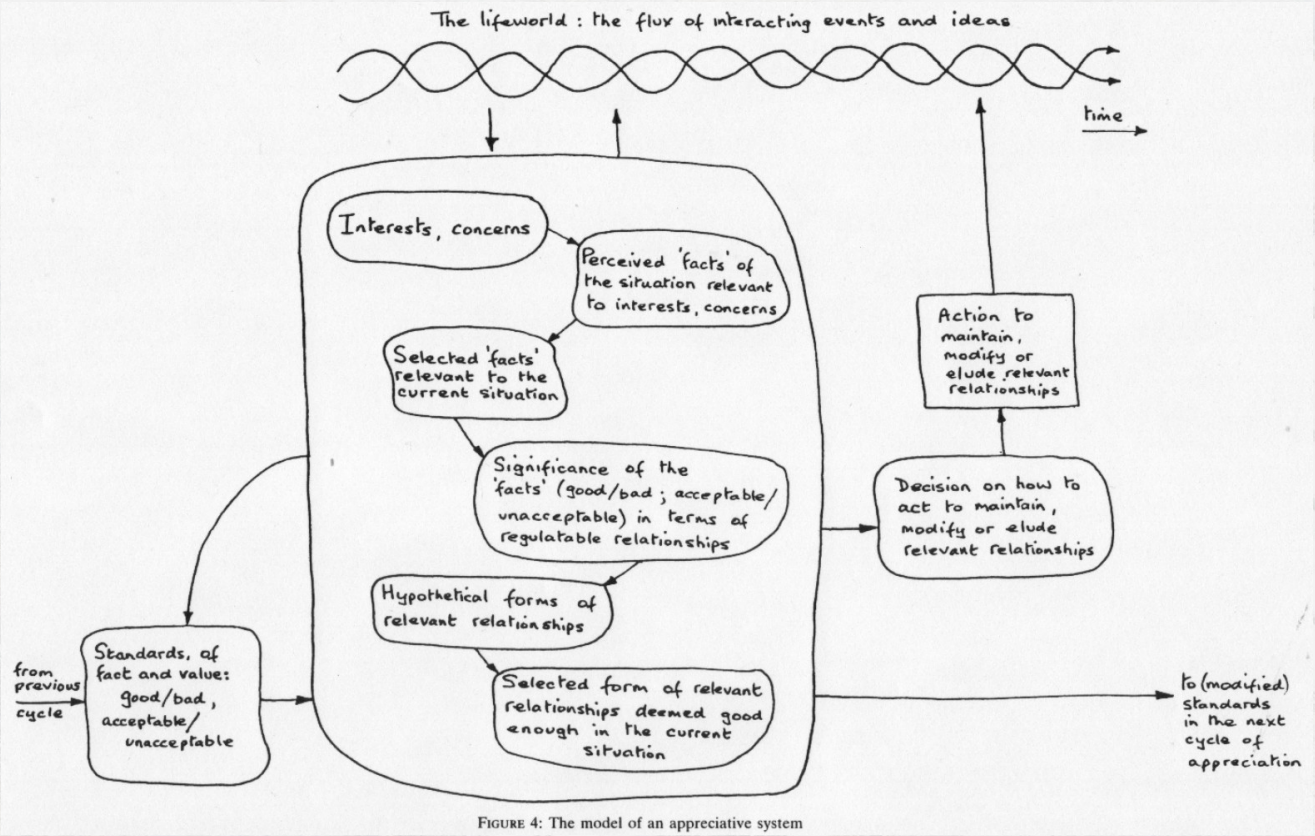


FIGURE 4: The model of an appreciative system

The form of the **appreciative system** remains the same while its **contents (its 'settings')** continually (but not necessarily continuously) **change**.

An appreciation system is a process whose products – cultural manifestations – condition the process itself.

It is **operationally closed** via a structural component (the flux of events and ideas) which ensures that it does not through its actions **reproduce** itself exactly. [….]

Through its (changing) filters it is **always open to new inputs** from the flux of events and ideas, a characteristic which seems essential if the model is to map our everyday experience of the **shifting** perceptions and judgements and structures of the world of culture.

Checkland, Peter B., and Alejandro Cesar. 1986. "Vickers' Concept of an Appreciative System: A Systemic Account." *Journal of Applied Systems Analysis* 13 (3): 3–17.

The appreciative system is open to the flux of events and ideas, and reproduces itself through a natural drift over time

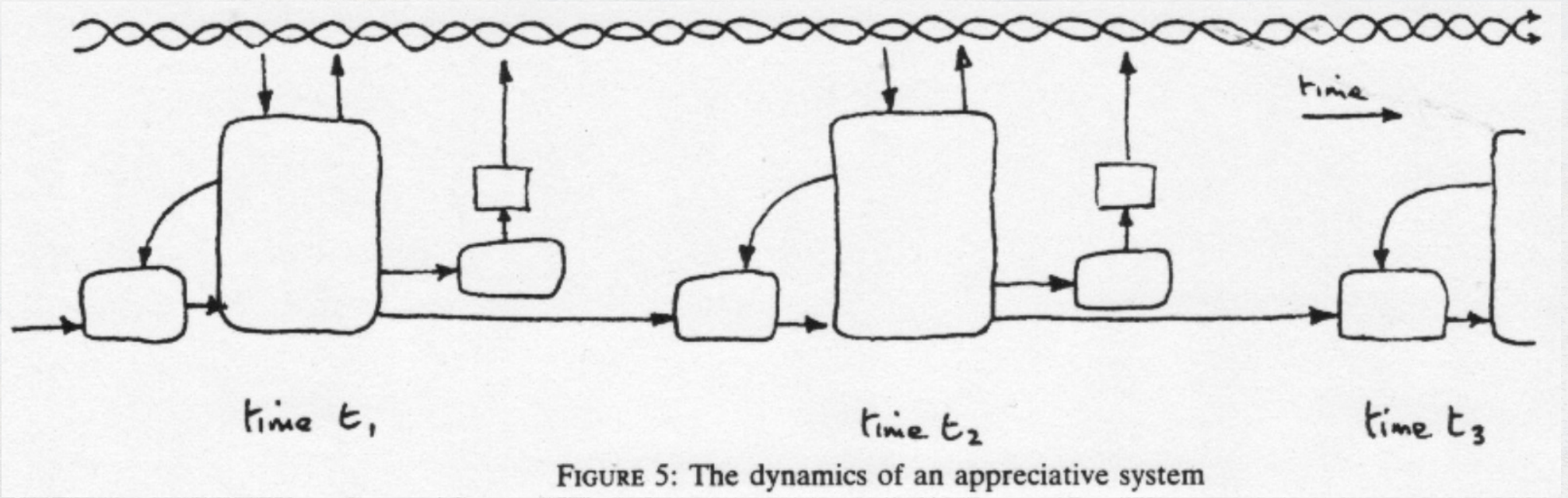
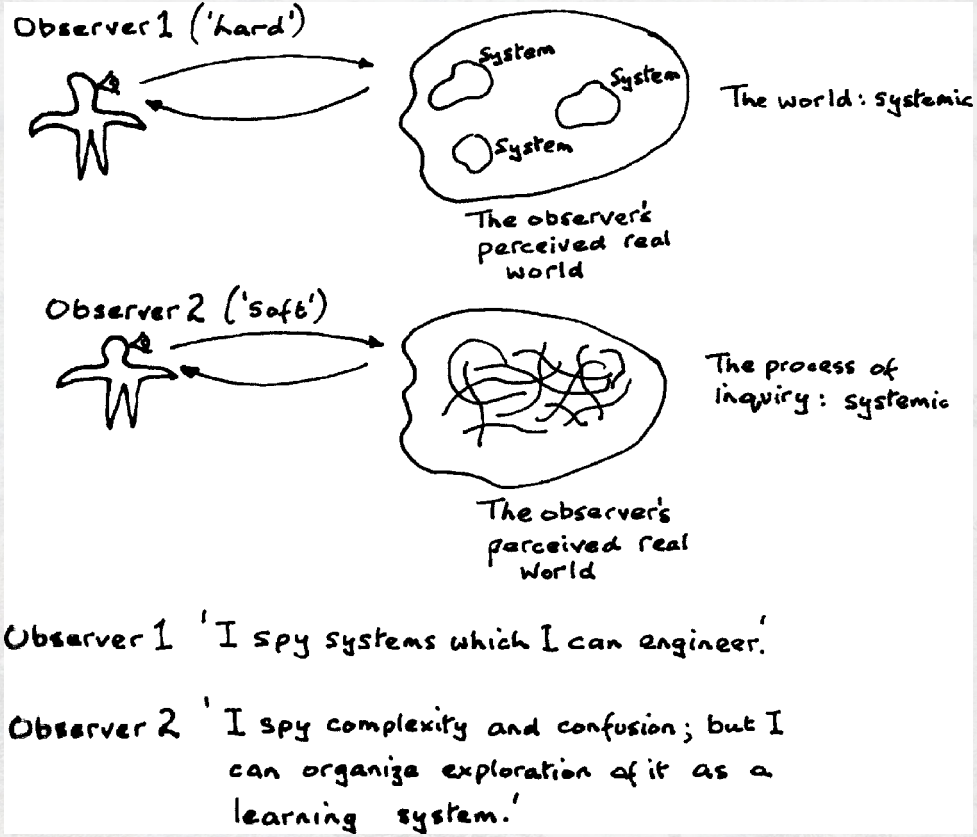


FIGURE 5: The dynamics of an appreciative system

Checkland, Peter B., and Alejandro Cesar. 1986. "Vickers' Concept of an Appreciative System: A Systemic Account." *Journal of Applied Systems Analysis* 13 (3): 3–17.

Soft Systems Methodology was developed as response to the hard systems stance of Systems Engineering involving human beings



… changes had to be made to **Systems Engineering** when it proved **too blunt** an instrument to deal with the **complexity of human situations**. [….]

Its **belief** is: the world contains **interacting systems**. They **can be 'engineered' to achieve their objectives**. This is the stance not only of SE; this thinking also underpins classic Operational Research, RAND Corporation 'systems analysis', the Viable System Model, early applications of System Dynamics and the original forms of computer systems analysis.

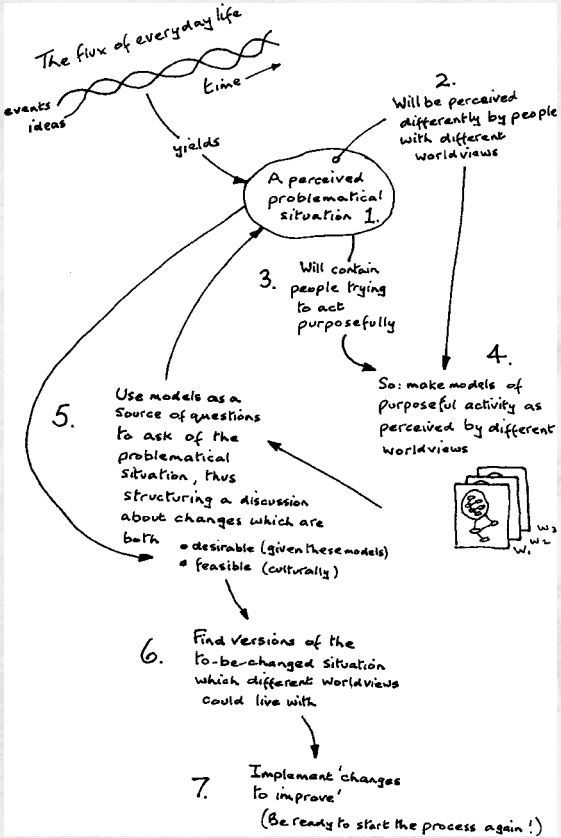
None of these approaches pays **attention** to the existence of **conflicting worldviews**, something which characterizes all social interactions.

… it was necessary to **abandon the idea** that the **world is a set of systems**. In SSM the **(social) world** is taken to be very complex, problematical, mysterious, characterized by **clashes of worldview**. It is continually being **created and recreated** by people thinking, talking and taking action.

However, our coping with it, our process of inquiry into it, can itself be organized as a learning system. So the notion of systemicity ('systemness') appears in the process of inquiry **into the world, rather than in the world itself**.

Checkland, Peter, and John Poulter. 2010. "Soft Systems Methodology." In *Systems Approaches to Managing Change: A Practical Guide*, edited by Martin Reynolds and Sue Holwell. London: Springer London. http://dx.doi.org/10.1007/978-1-84882-809-4_5 .

Soft Systems Methodology (SSM) has a cycle of learning for action, as an organized way of tackling perceived problematic (social) situations



… the existence of **conflicting worldviews** and ubiquity of **would-be purposeful action** … lead the way to tackling **problematic** situations.

1. Find out about both the **problematical situation** and the **characteristics of the intervention** to improve it: the issues, the prevailing culture and the disposition of power within the overall situation (its politics).
2. … decide upon some **relevant purposeful activities**, ... remembering that the **ultimate aim is to define and take 'action to improve'** . Express these relevant purposeful activities as **activity models**, ...
3. Use the **models** as a **source of questions** to ask of the real-world situation. … **surface worldviews** and generate ideas for change and improve-ment.
4. … continually bring together the results of the **'finding out' in (1)** and the **ideas for change in (3)**. The purpose now is to **find changes** which are both **arguably desirable** (given these models) but also **culturally feasible** for these people in this particular situation

The elements (1) to (4) above constitute **a learning cycle**.

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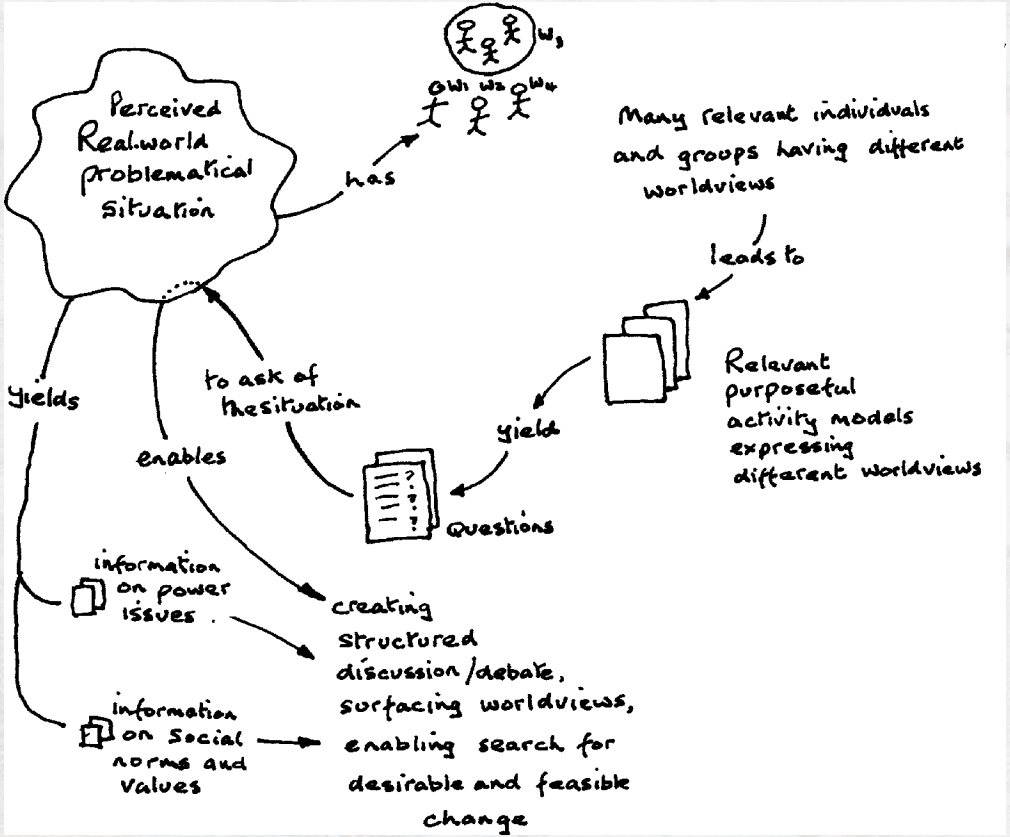
SSM has (i) a situation calling for action; (ii) activity relevant to the situation; (iii) a process using models; and (iv) structured debate about desirable + feasible change



… these purposeful activity models *can never be* ***descriptions*** of (part of) the real world. Each of them expresses ***one way of looking at and thinking about*** the real situation, and there will be multiple possibilities.

So how can such models be made useful?

The answer is to **see them as *devices*** (intellectual devices) which are a source of ***good questions to ask*** *about the real situation* , enabling it to be explored richly.

Given the **different worldviews** ... means finding possible changes ... **arguably desirable**, given the outcomes of using the models to question the real situation, but must also be **culturally feasible** for these particular people in this particular situation with unique history and the unique **narrative** which its participants will have **constructed over time** in order to make sense of their experience.

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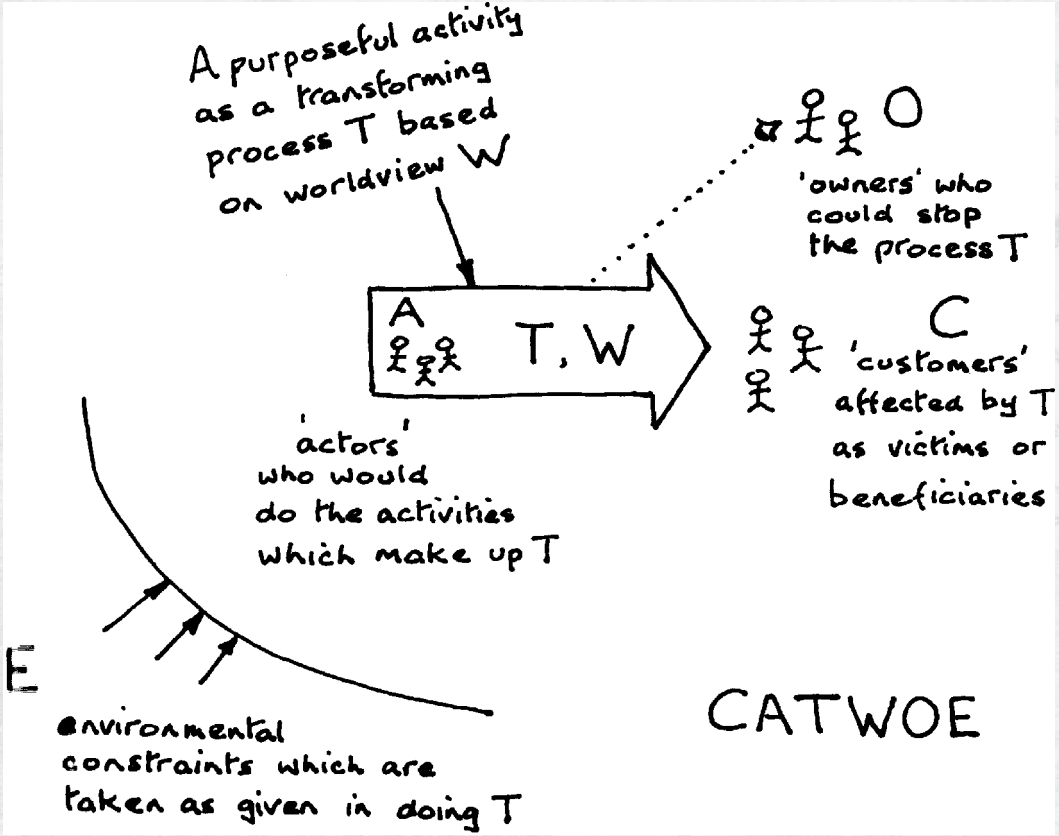
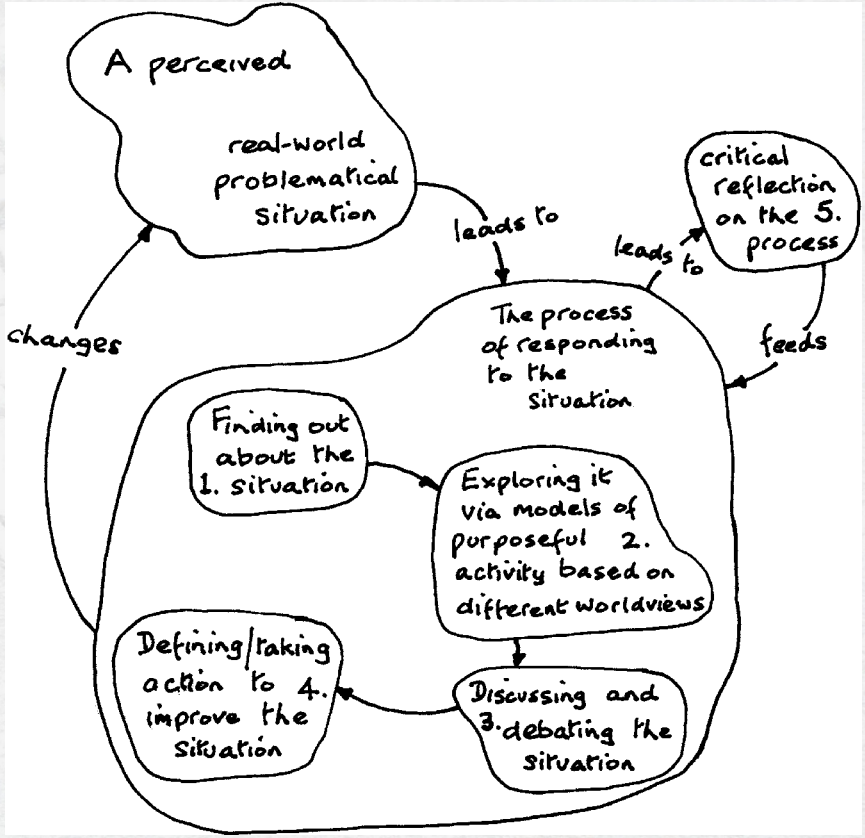
A generic model of purposeful activity includes CATWOE, towards the five activities which flow from SSM's seven principles





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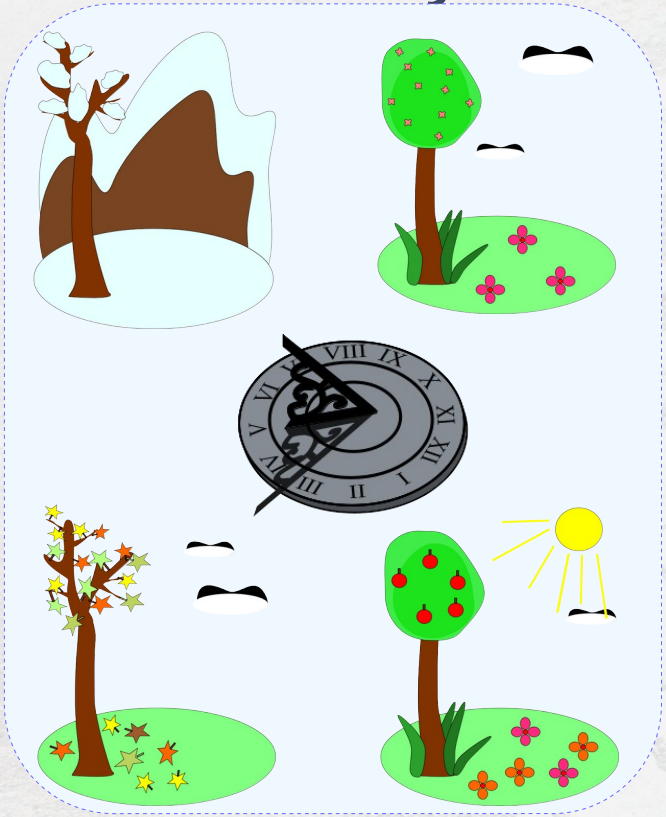
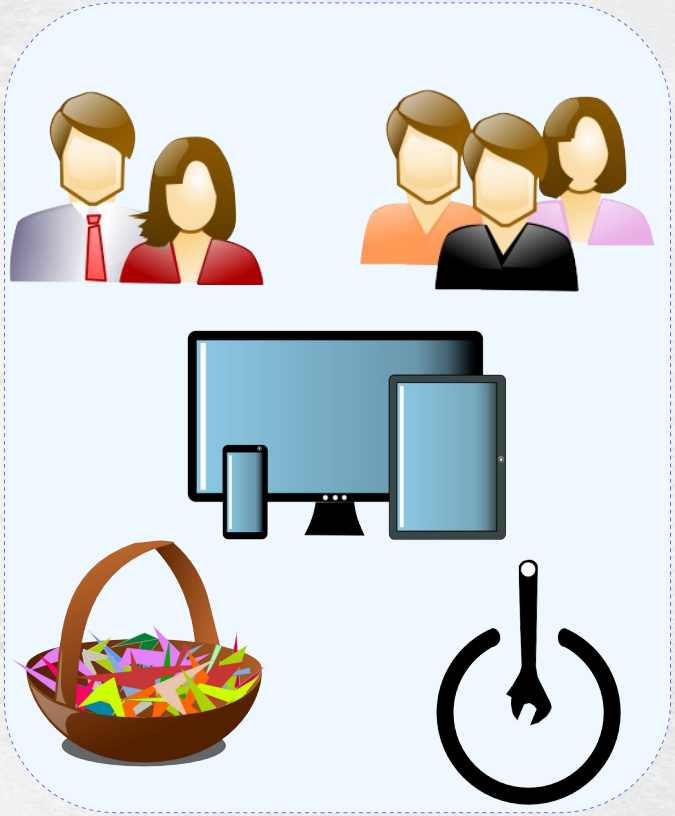
Is thinking different across agricultural systems, industrial systems, and service systems?

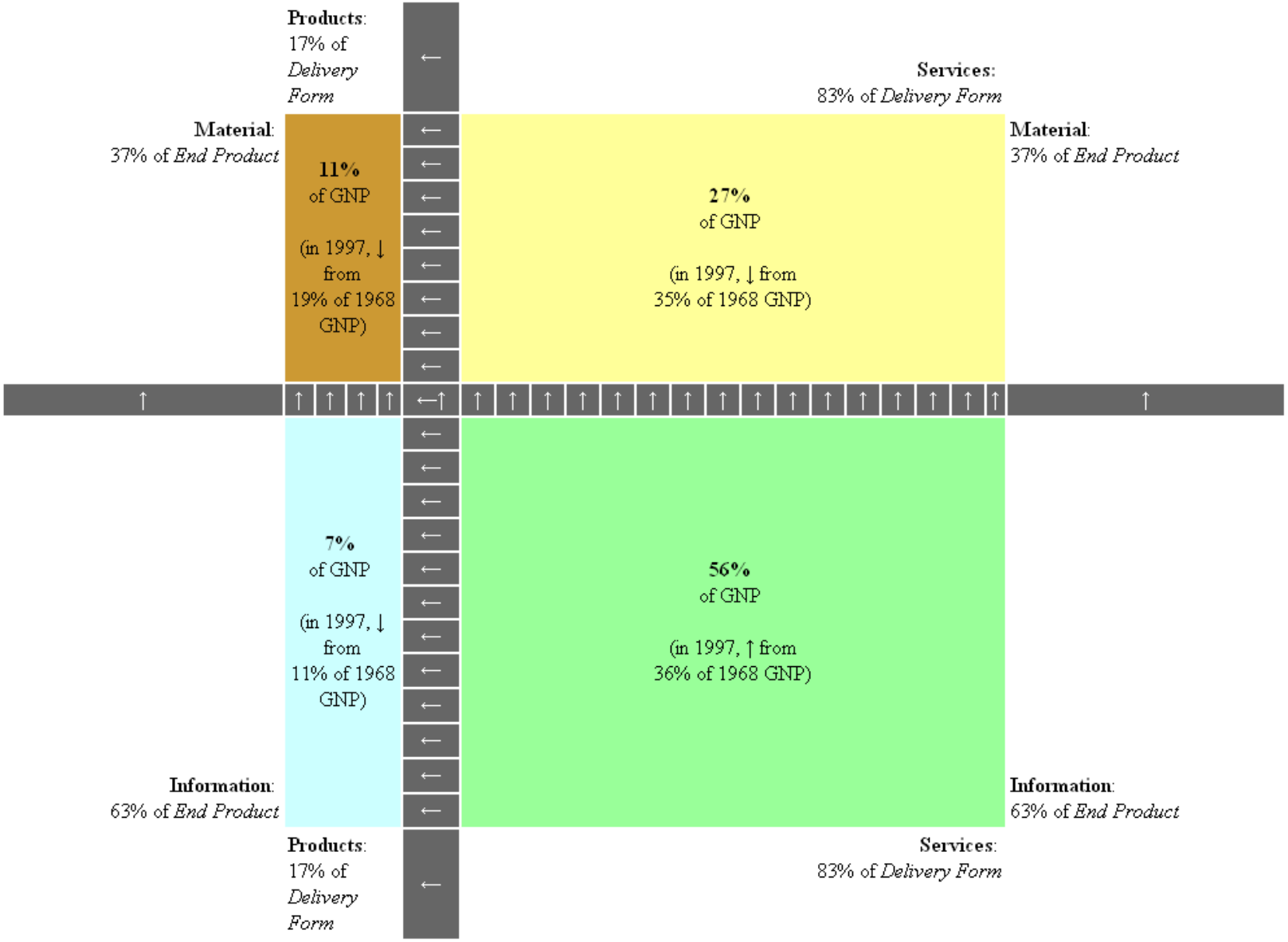


Agricultural Systems

Industrial Systems

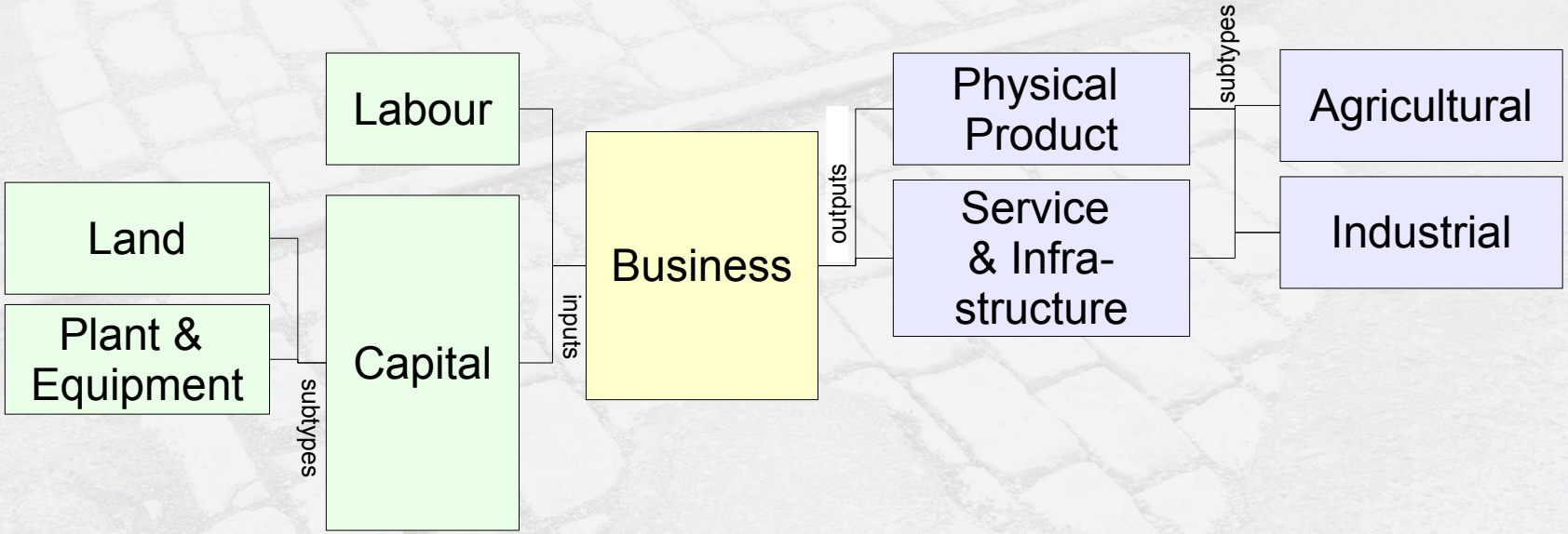


Service Systems(?)

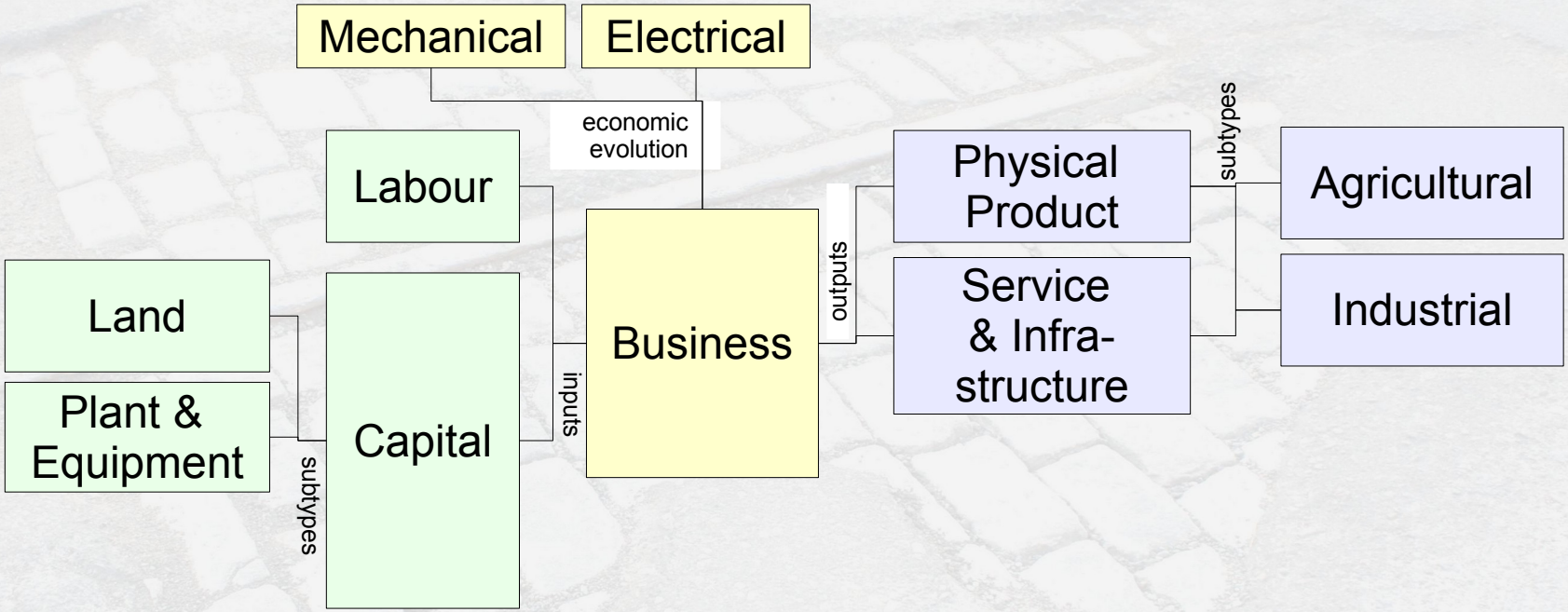


Uday M. Apte, Uday S. Karmarkar and Hiranya K Nath, "Information Services in the US Economy: Value, Jobs and Management", *Business and Information Technologies (BIT) Project*, Anderson School of Management at UCLA, June 2007

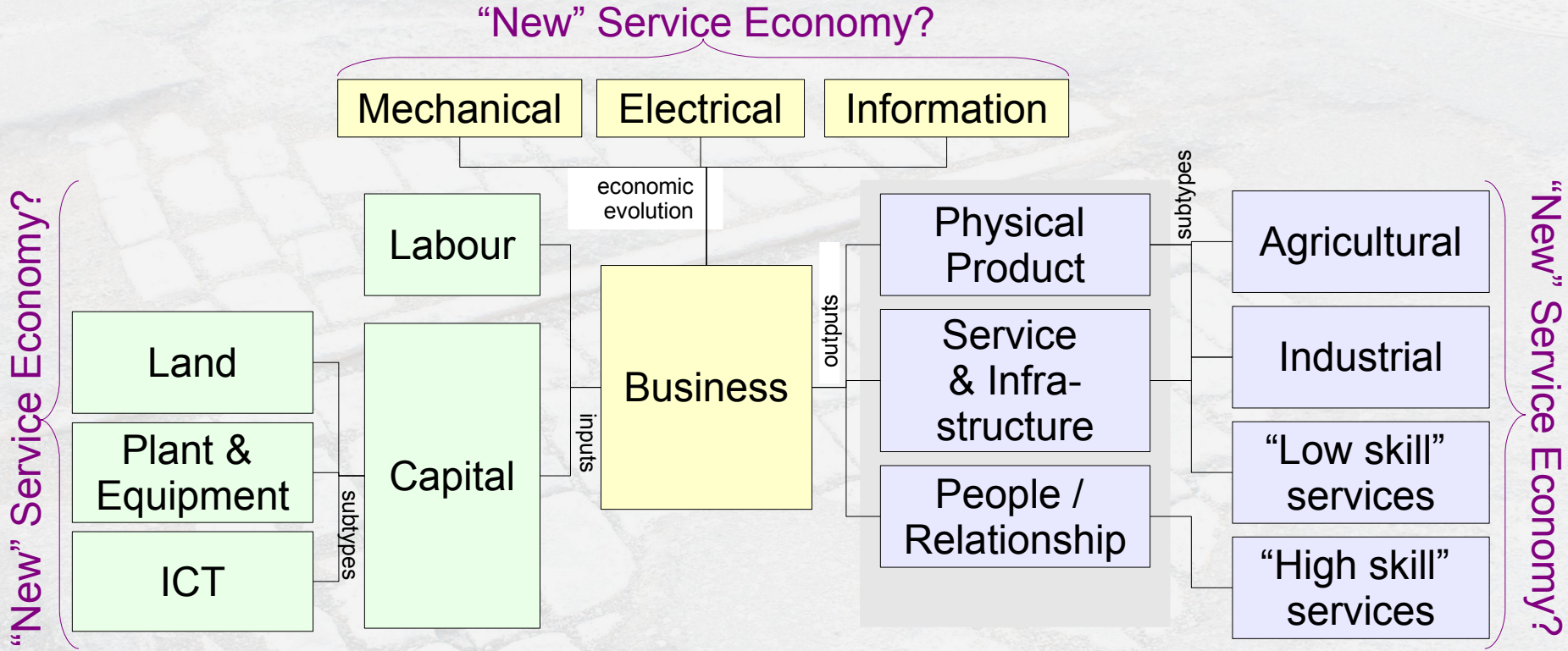
Inputs and outputs (physical product, service + infrastructure)



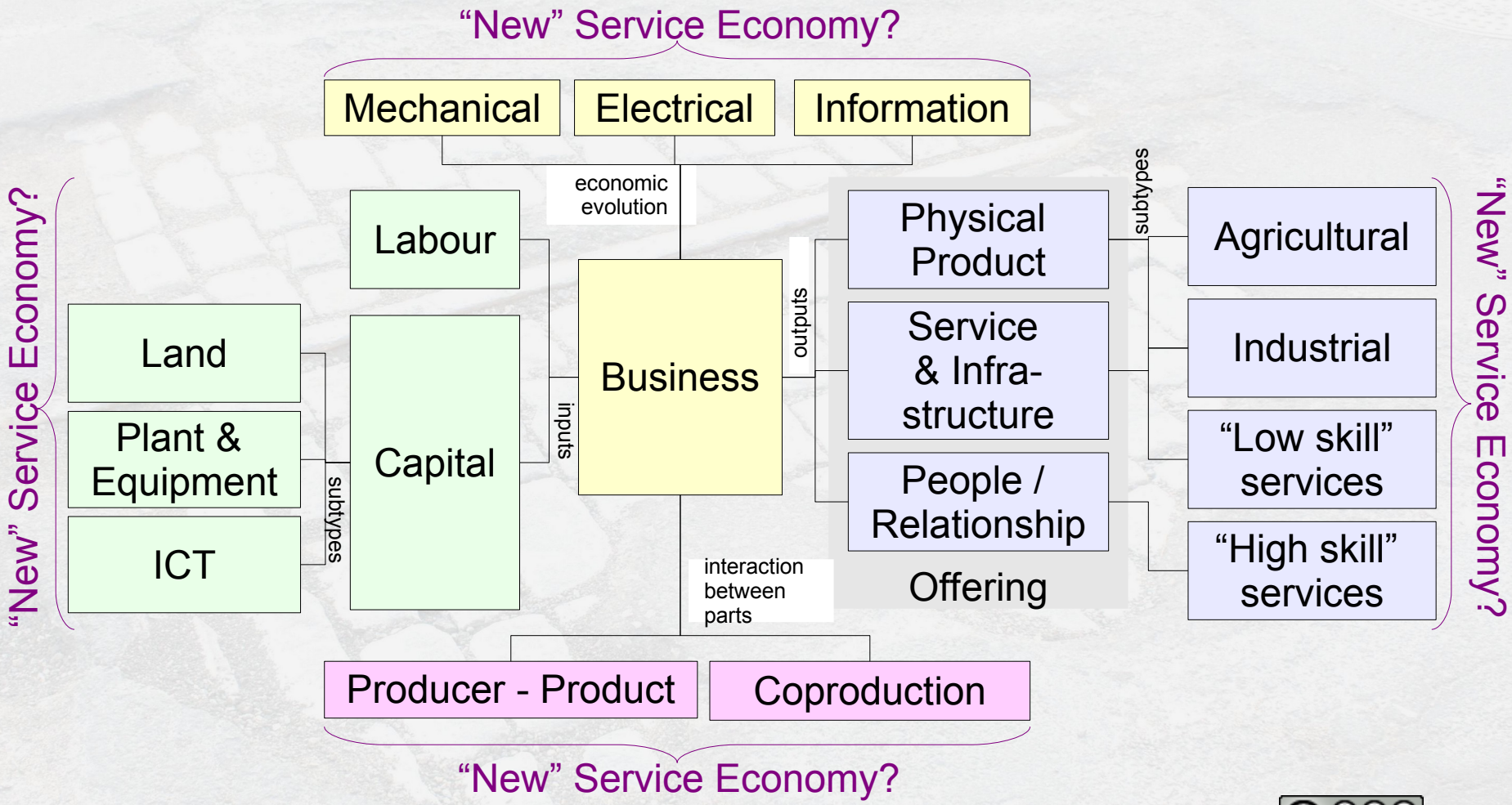
Economic evolution with mechanical and electrical



New service economy: on inputs, processes, outputs?



Interaction between parts: producer-product and coproduction

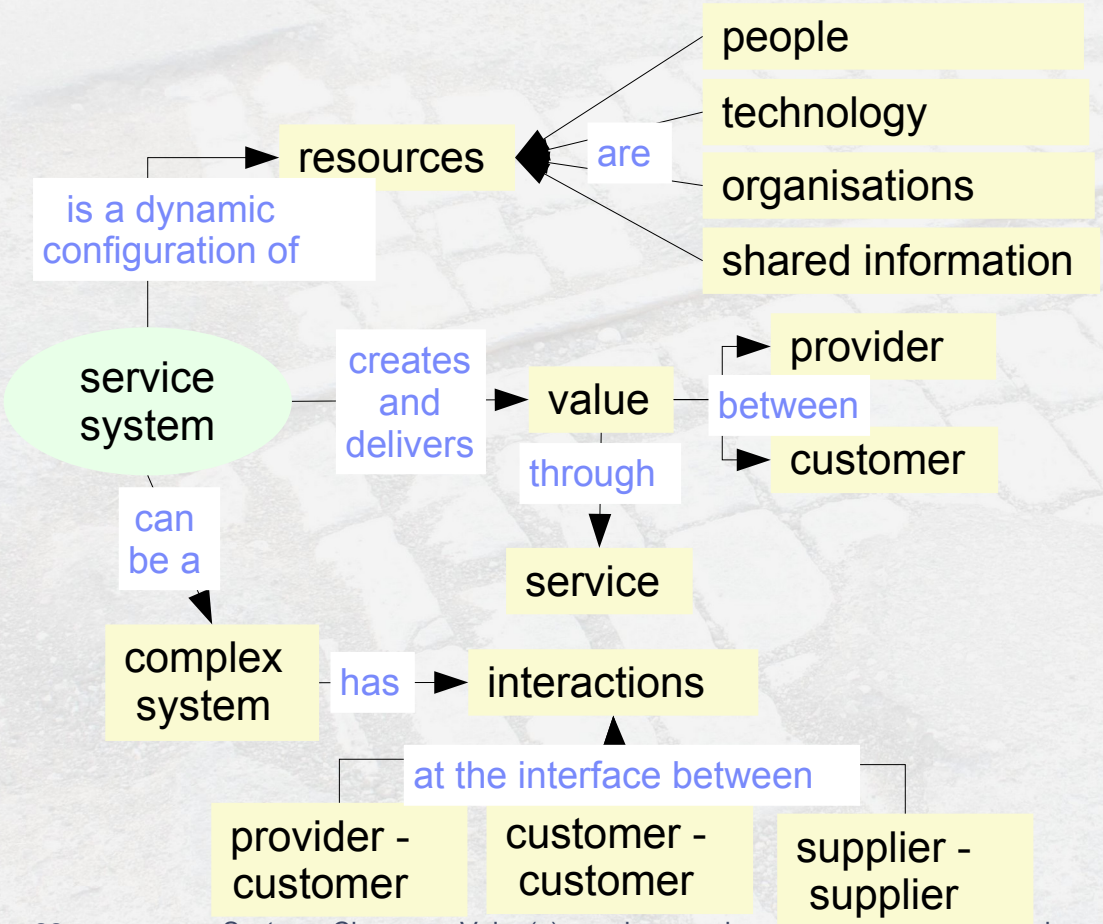


Service systems in our society can be ranked from concrete to abstract, as subjects for schoolchildren

Systems that move, store, harvest, process	• Transportation	K
	• Water and waste management	1
	• Food and global supply chain	2
	• Energy and energy grid	3
	• Information + communications (ICT) infrastructure	4
Systems that enable healthy, wealthy and wise people	• Building and construction	5
	• Banking and finance	6
	• Retail and hospitality	7
	• Healthcare	8
	• Education (including universities)	9
Systems that govern	• Government (cities)	10
	• Government (regions / states)	11
	• Government (nations)	12

Source: Spohrer, James C., and Paul P. Maglio. 2010. "Toward a Science of Service Systems: Value and Symbols." In Service Science: Research and Innovations in the Service Economy, edited by Paul P. Maglio, Cheryl A. Kieliszewski, and James C. Spohrer, 157–94. 10.1007/978-1-4419-1628-0_9

After 2007, service systems have been recognized as the largest part of developed economies globally



A **service system** can be defined as a **dynamic configuration** of **resources** (people, technology, organisations and shared information) that **creates and delivers value** between the provider and the customer through service.

In many cases, a service system is a **complex system** in that configurations of resources interact in a non-linear way.

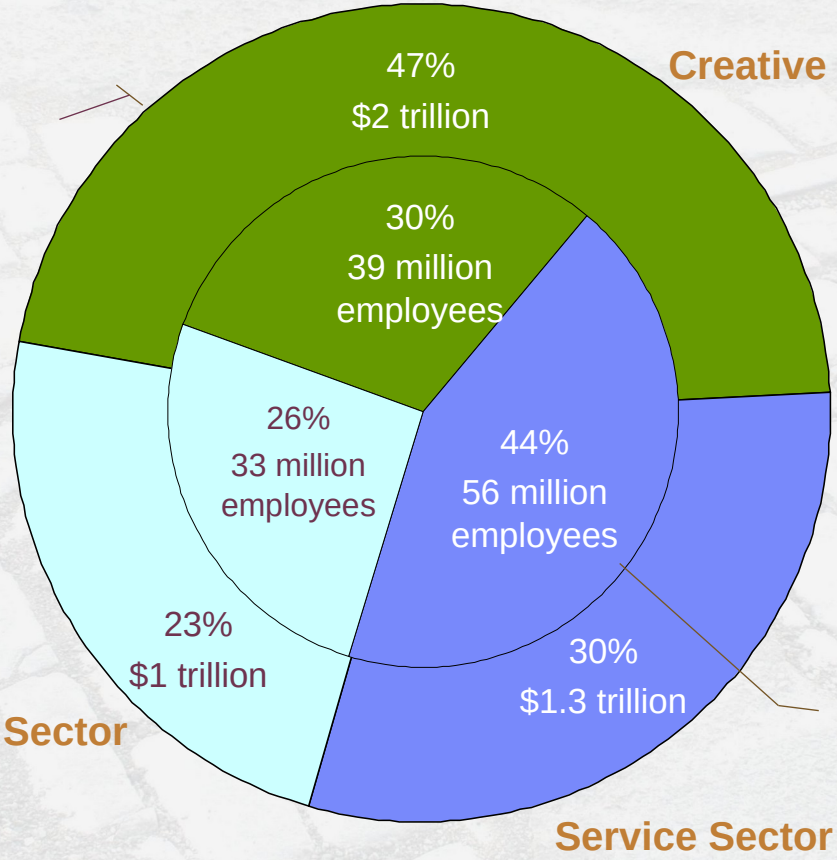
Primary interactions take place at the interface between the provider and the customer.

However, with the advent of ICT, customer-to-customer and supplier-to-supplier **interactions** have also become prevalent.

These complex interactions createa system whose behaviour is difficult to explain and predict.

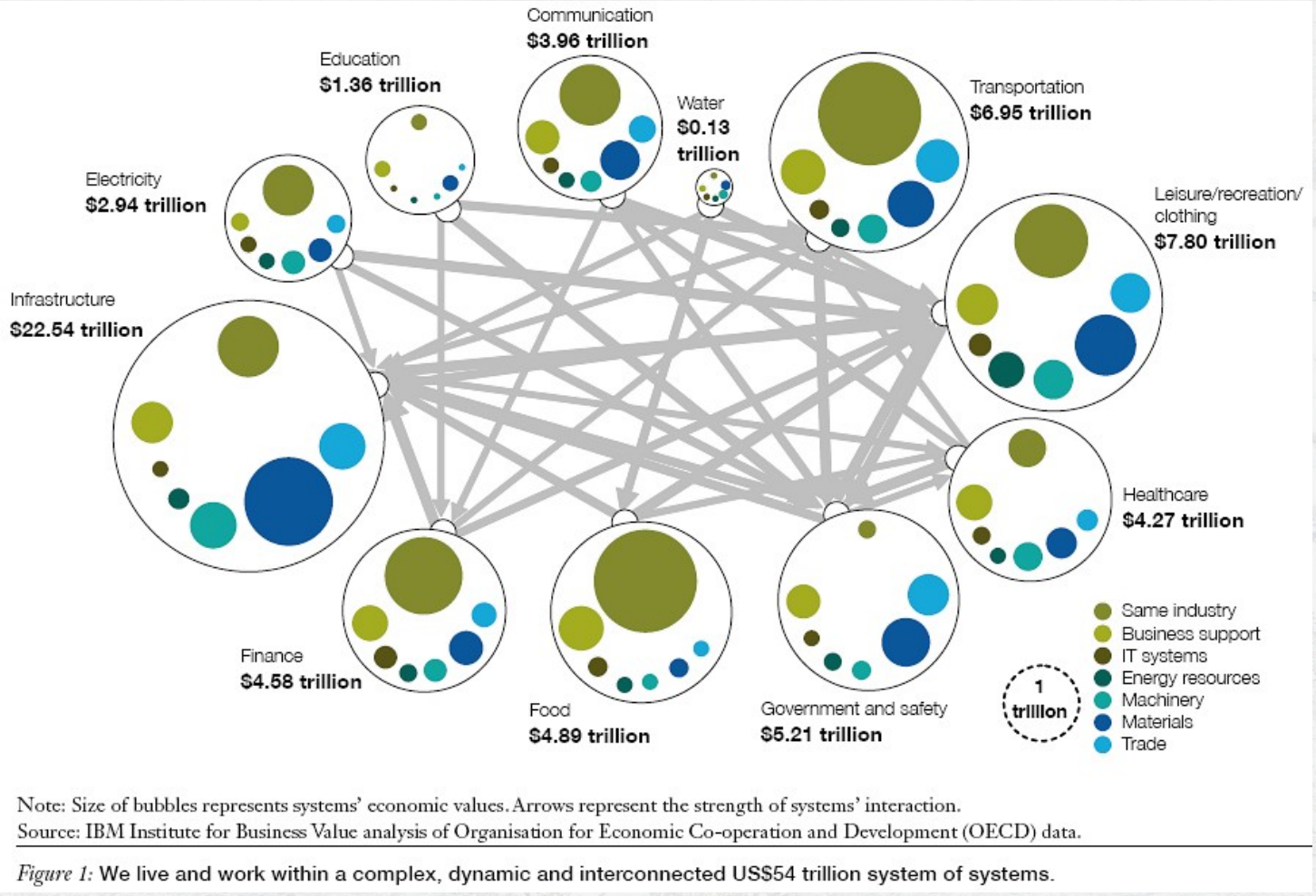
(IfM and IBM, 2008, p. 6)

Creative class generates greater wealth per employee



Source:
Richard L. Florida (2004) *The flight of the creative class : The new global competition for talent.*

US$54 trillion system of systems -- IBM



Note: Size of bubbles represents systems' economic values. Arrows represent the strength of systems' interaction.
Source: IBM Institute for Business Value analysis of Organisation for Economic Co-operation and Development (OECD) data.

Figure 1: We live and work within a complex, dynamic and interconnected US$54 trillion system of systems.

IBM. 2010. "The World's 4 Trillion Dollar Challenge: Using a System-of-Systems Approach to Build a Smarter Planet." GBE03278-USEN-02. *Institute for Business Value*. http://www-935.ibm.com/services/us/gbs/bus/html/ibv-smarter-planet-system-of-systems.html
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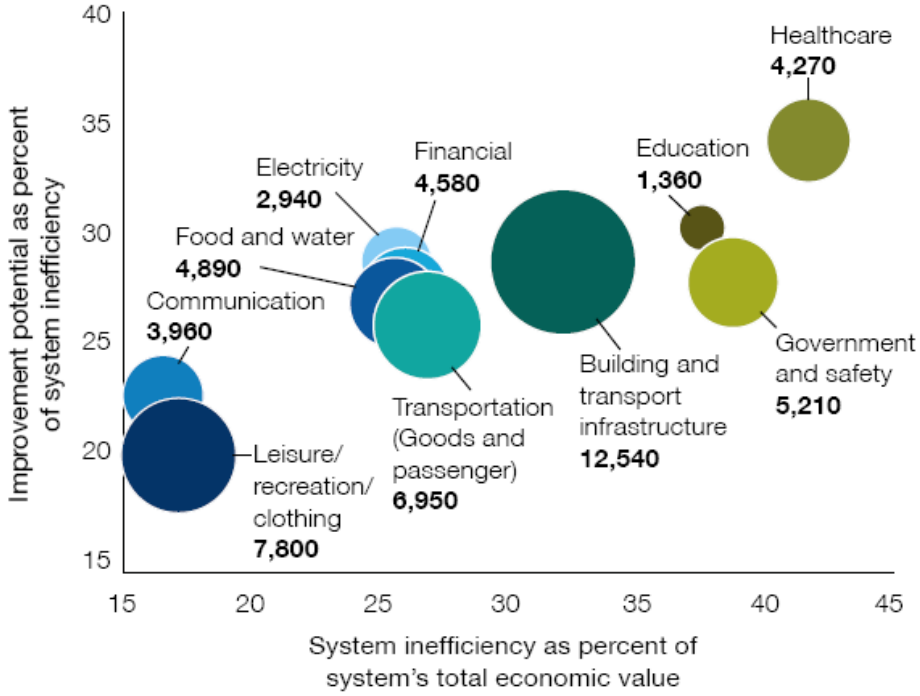
The world's $4 trillion challenge -- IBM



Note: Size of the bubble indicates absolute value of the system in US$ billions
Source: IBM Institute for Business Value analysis based on inefficiency and improvement potential estimates reported during 2009 survey of 518 economists.

Figure 2: Of the US$15 trillion in inefficiencies within our global system, approximately US$4 trillion could be eliminated.

IBM. 2010. "The World's 4 Trillion Dollar Challenge: Using a System-of-Systems Approach to Build a Smarter Planet." GBE03278-USEN-02. *Institute for Business Value*. http://www-935.ibm.com/services/us/gbs/bus/html/ibv-smarter-planet-system-of-systems.html .

Service systems are dynamic, with parties interacting and providers and/or clients

A service system can be defined as "**a dynamic value-cocreation configuration of resources**, including people, organizations, shared information (language, laws, measures, methods), and technology, all connected internally and externally to other service systems by **value propositions**"
(Maglio, Vargo, Caswell, & Spohrer, 2009, p. 399).

The smallest service system centers on an individual as he or she **interacts** with others, and the largest service system comprises the global economy. Cities, city departments, businesses, business departments, nations, and government agencies are all service systems.

Every service system is **both a provider and client of service** that is connected by **value propositions** in value chains, value networks, or value-creating system ….
(Maglio & Spohrer, 2008, p. 18)

Basic Concepts (#1-5). If we are to understand human history as the evolution and design of value-cocreation mechanisms between entities, then where should we begin?

Let's start by understanding the following ten basic concepts:

1.	**Resources**	Businesses may own physical resources or contract for physical resources, but as a type of resource they are themselves not physical, but instead a conceptual-legal construct. So in the end, all resources fall into one of four types: *physical-with-rights, not-physical-with-rights, physical-with-no-rights, and not-physical-with-rights.*
2.	**Service system entities**	The most common types of service system entities are people and organizations. New types of service system entities are constantly emerging and disappearing. Recently, open-source and on-line communities have emerged as service systems entities.
3.	**Access rights**	"By what authority, do you use that resource?" Service system entities have four main types of access rights to the resources within their configuration: *owned outright*, *leased/contracted*, *shared access*, and *privileged access*. Shared access resources include resources such as air, roads, natural language, and internet web sites. Privileged access resources include resources such as thoughts, individual histories, and family relationships.
4.	**Value-proposition-based interactions**	"I'll do this, if you'll do that." [….] Interactions via value propositions are intended to cocreate-value for both interacting entities. Both interacting entities must agree, explicitly or tacitly, to the value proposition.
5.	**Governance mechanisms**	"Here's what will happen if things go wrong." [….] If value is not realized as expected, this may result in a dispute between the entities. Governance mechanisms reduce the uncertainty in these situations by prescribing a mutually agreed to process for resolving the dispute.

Source: Jim Spohrer and Stephen K. Kwan. 2009. "Service Science, Management, Engineering, and Design (SSMED): An Emerging Discipline - Outline & References." *International Journal of Information Systems in the Service Sector* 1 (3): 1–31.

Basic Concepts (#6-10). If we are to understand human history as the evolution and design of value-cocreation mechanisms between entities, then where should we begin?

Let's start by understanding the following ten basic concepts:

6.	**Service system networks**	"Here's how we can all link up." [….] Over time, for a population of entities, the patterns of interaction can be viewed as networks with direct and indirect connectivity strengths. A service system network is an abstraction that only emerges when one assumes a particular analysis overlay on the history of interactions amongst service system entities.
7.	**Service system ecology**	"Populations of entities, changing the ways they interact." Different types of service systems entities exist in populations, and the universe of all service system entities forms the service system ecology or service world ….
8.	**Stakeholders**	"When it comes to value, perspective really matters." The four primary types of stakeholders are *customer*, *provider*, *authority*, and *competitor*. In addition … other stakeholder perspectives include employee, partner, entrepreneur, criminal, victim, underserved, citizen, manager, children, aged, and many others.
9.	**Measures**	"Without standardized measures, it is hard to agree and harder to trust." The four primary types of measures are *quality*, *productivity*, *compliance*, and *sustainable innovation*.
10.	**Outcomes**	"How did we do? Can this become a new routine or long-term relationship?" […] Beyond a standard two player game, with a customer player and a provider player, ISPAR assumes there exists both an authority player as well as a competitor-criminal player.

Source: Jim Spohrer and Stephen K. Kwan. 2009. "Service Science, Management, Engineering, and Design (SSMED): An Emerging Discipline - Outline & References." *International Journal of Information Systems in the Service Sector* 1 (3): 1–31.

These ten basic concepts underlie the service systems worldview

1. **Resources**
2. **Service system entities**
3. **Access rights**
4. **Value-proposition-based interactions**
5. **Governance mechanisms**
6. **Service system networks**
7. **Service system ecology**
8. **Stakeholders**
9. **Measures**
10. **Outcomes**

…… the world is made up of
populations of **service system entities** that **interact (normatively)** via value propositions to **cocreate-value**,
but often disputes arise and so
governance mechanisms are invoked to resolve disputes.

Formal service system entities are types of legal entities with rights and responsibilities, that can own property, and with named identities that can create contracts with other legal entities. [….] Formal service systems exist within a legal and economic framework of contracts and expectations.

Informal service system entities include families ...,
open source communities ..., and many other societal or social systems that are governed typically by unwritten cultural and behavioral norms (social systems with rudimentary political systems).

Natural history of service system entities. Service science seeks to create an understanding of the formal and informal nature of service in terms of entities, interactions, and outcomes, and how these evolve (or are designed) over time. An initial premise is that the entities, which are sophisticated enough to engage in rationally designed service interactions that can consistently lead to win-win value cocreation outcomes, must be able to build models of the past (reputation, trust), present, and future (options, risk-reward, opportunities, hopes and aspirations) possible worlds, including models of themselves and others, and reason about knowledge value ….

Source: Jim Spohrer and Stephen K. Kwan. 2009. “Service Science, Management, Engineering, and Design (SSMED): An Emerging Discipline - Outline & References.” *International Journal of Information Systems in the Service Sector* 1 (3): 1–31.

Basic questions. A general theory of service system entities and networks formed through value-proposition-based interactions has four parts

… which directly lead to the four basic types of questions that SSMED seeks to answer.

Science (improve understanding, map natural history, validate mechanisms, make predictions).
What are service system entities, how have they naturally evolved to present, and how might they evolve in the future? What can we know about their interactions, how the interactions are shaped (value propositions, governance mechanisms), and the possible outcomes of those interactions both short-term and long-term?

Management (improve capabilities, define progress measures, optimize investment strategy).
How should one invest to create, improve, and scale service system networks? How do the four measures of quality, productivity, compliance, and sustainable innovation relate to numerous key performance indicators (KPIs) of business and societal systems? Is there a "Moore's Law" of service system investment? Can doubling information lead to a doubling of capabilities (performance) on a predictable basis?

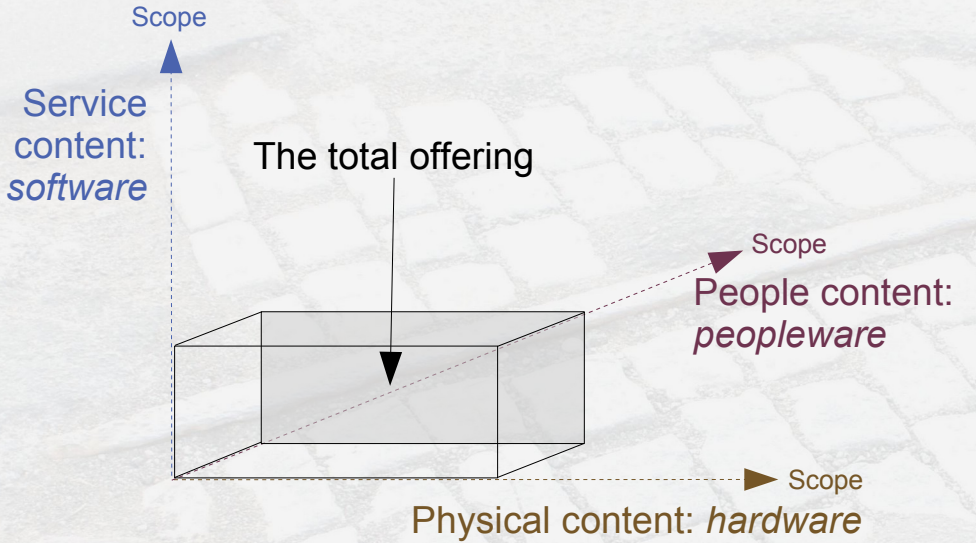
Engineering (improve control, optimize resources).
How can the performance of service system entities and scaling of service system networks be improved by the invention of new technologies (and environmental infrastructures) or the reconfiguration of existing ones? What is required to develop a CAD (Computer-Aided Design) tool for service system entity and service system network design?

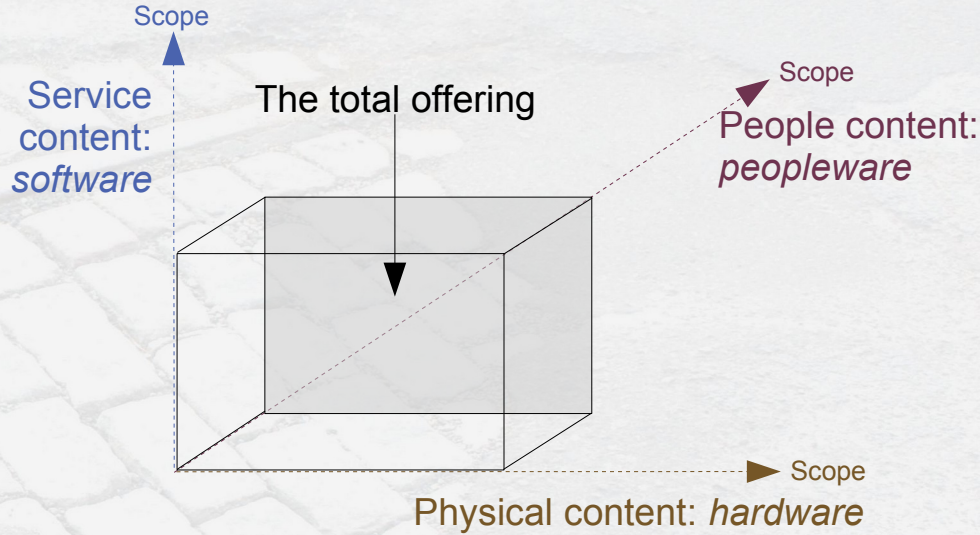
Design (improve experience, explore possibilities).
How can one best improve the experience of people in service system entities and networks? How can the experience of service system creation, improvement, and scaling be enhanced by better design? Can the space of possible value propositions and governance mechanisms be explored systematically?

Sciences of the artificial.
Sciences of the artificial are different from natural sciences, and so it becomes especially important to consider these four parts – science, management, engineering, and design – as important knowledge components. In "The Sciences of the Artificial" (Simon 1996), Simon reflects "The world we live in today is much more man-made, or artificial, world than it is a natural world....
Service Science, Management, Engineering, and Design (SSMED) is emerging as one of the sciences of the artificial. Service science is knowledge about service system entities, value-proposition-based interactions (or value-cocreation mechanisms), governance mechanisms, and the other seven basic concepts. Following Simon even further, one could argue that service system entities are physical symbol systems, dealing with symbols that are named resources, and grounded in physical routines for carrying out the symbolic manipulations related to named resources.

Source: Jim Spohrer and Stephen K. Kwan. 2009. "Service Science, Management, Engineering, and Design (SSMED): An Emerging Discipline - Outline & References." *International Journal of Information Systems in the Service Sector* 1 (3): 1–31.

Offerings are interactions that provide benefits in the form of (i) physical products, (ii) service and infrastructure, and (iii) interpersonal relationship



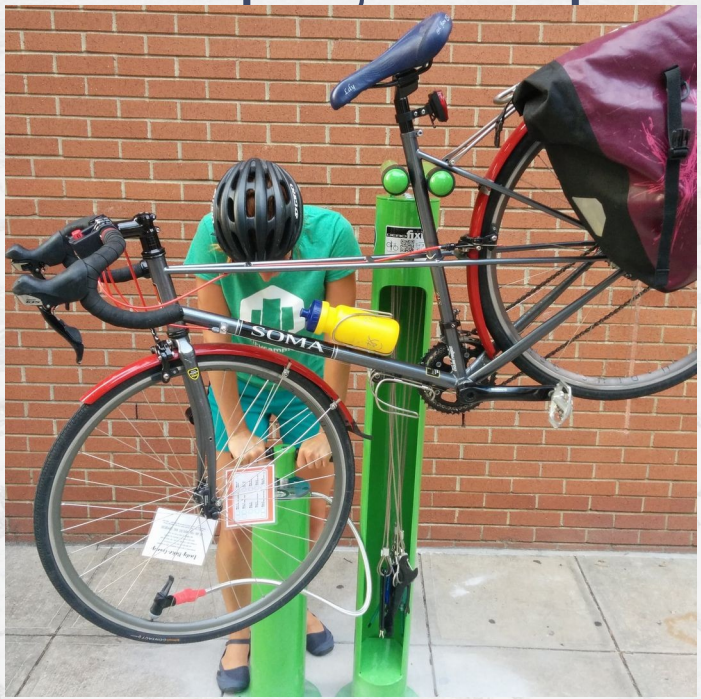


General Motors has historically been more **transaction focused**, and long-lasting relationships have not been seen as a worthwhile goal.

Toyota tries to develop **long-term partnerships** with its suppliers

Rafael Ramirez and Johan Wallin. *Prime Movers: Define Your Business or Have Someone Define It Against You*, 2000, p. 50.

An offering can be an output, an input or a co-creation



Offerings-output production

- Providers fix bundles of offerings from which customers select

Offerings-input coproduction

- Customers broaden the range of options through loose coupling

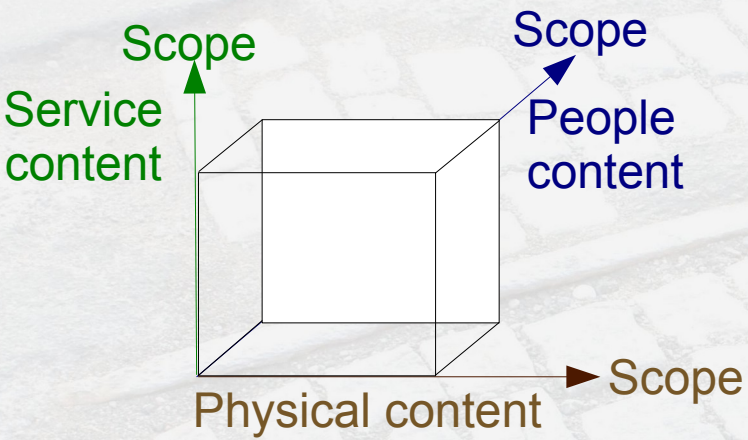
Value-elevating co-creation

- Providers and customer mutually experience, and then improve

Extended from Normann, Richard, and Rafael Ramírez. 1989. “A Theory of the Offering: Toward a Neo-Industrial Business Strategy.” In *Strategy Organisation Design, and Human Resource Management*, edited by Charles C. Snow, 111–28. J.A.I. Press; + Kijima, Kyoichi, and Yusuke Arai. 2016. “Value Co-Creation Process and Value Orchestration Platform.” In *Global Perspectives on Service Science*: Japan, edited by Kwan, Spohrer, and Sawatani, 137–54, Springer.

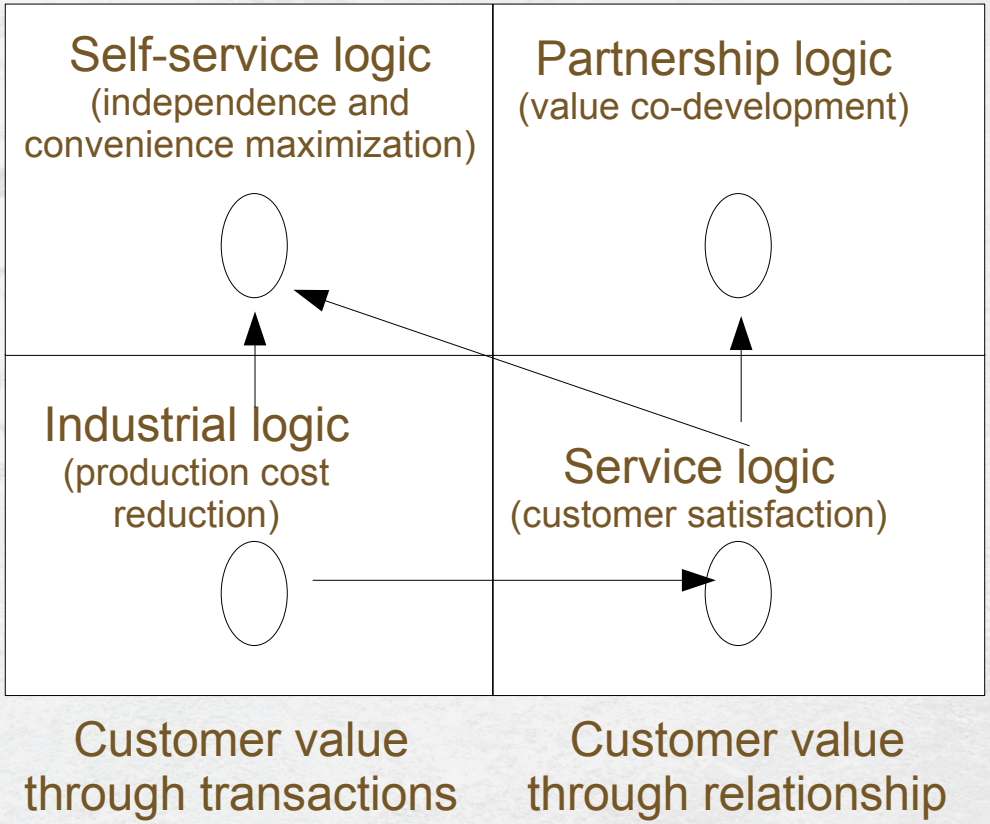
Images from Flickr: “Pimp My Ride” CC-BY 2011 Grey World; “”Oaks and Spokes Bicycle Repair Repair Station” CC-BY 2015 Kristy Dactyle; “Bettter Bike Share” CC-BY 2015 Better Bike Share Partnershp

An offering can either be an output of coproduction, or an input to coproduction



Offering as input

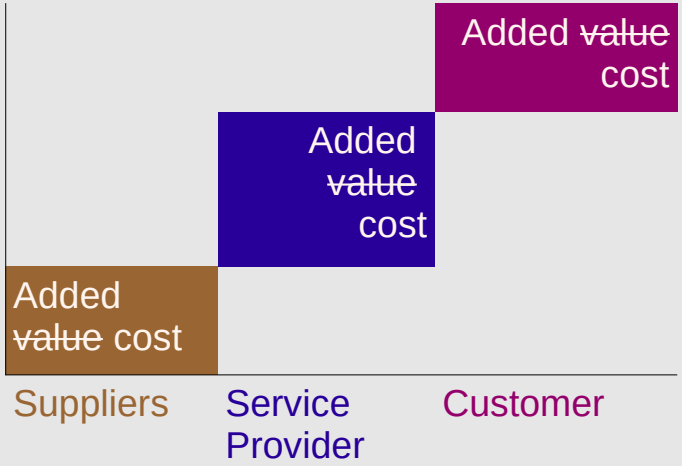
Offering as output



Rafael Ramirez and Johan Wallin. *Prime Movers: Define Your Business or Have Someone Define It Against You*, 2000, p. 141.

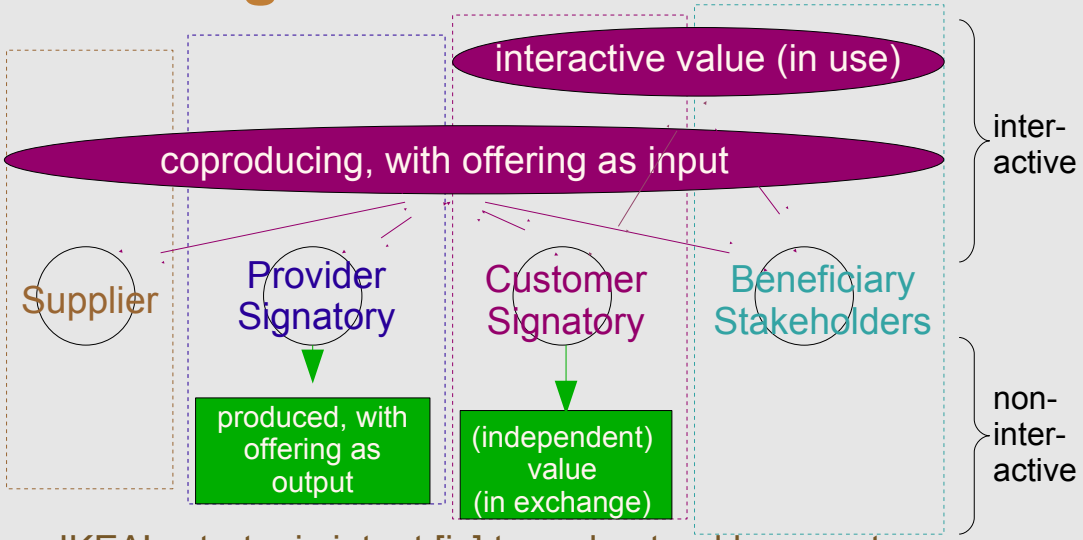
The theory of firms on “adding value” has turned to mobilizing interactive *value constellations*

Adding ~~value~~ cost



Our traditional about value … [says] every company occupies a position on the value chain. Upstream, suppliers provide inputs. The company then adds values to these inputs, before passing them downstream to then next actor in the chain [whether another business or the final consumer].

Enabling interactive value creation



… IKEA's strategic intent [is] to understand how customers can create their own value and create a business system that allows them to do it better. IKEA's goal is not to *relieve* customers of doing certain things but to *mobilize* them to do easily certain things they have never done before. Put another way, IKEA invents value by enabling customers' own value-creating activities. … Wealth is [the ability] to realize your own ideas.

Source: Richard Normann and Rafael Ramirez. 1993. “From Value Chain to Value Constellation: Designing Interactive Strategy.” Harvard Business Review 71: 65–65. http://hbr.org/1993/07/designing-interactive-strategy .

An organizational architecture positions for product change and process change as dynamic or static

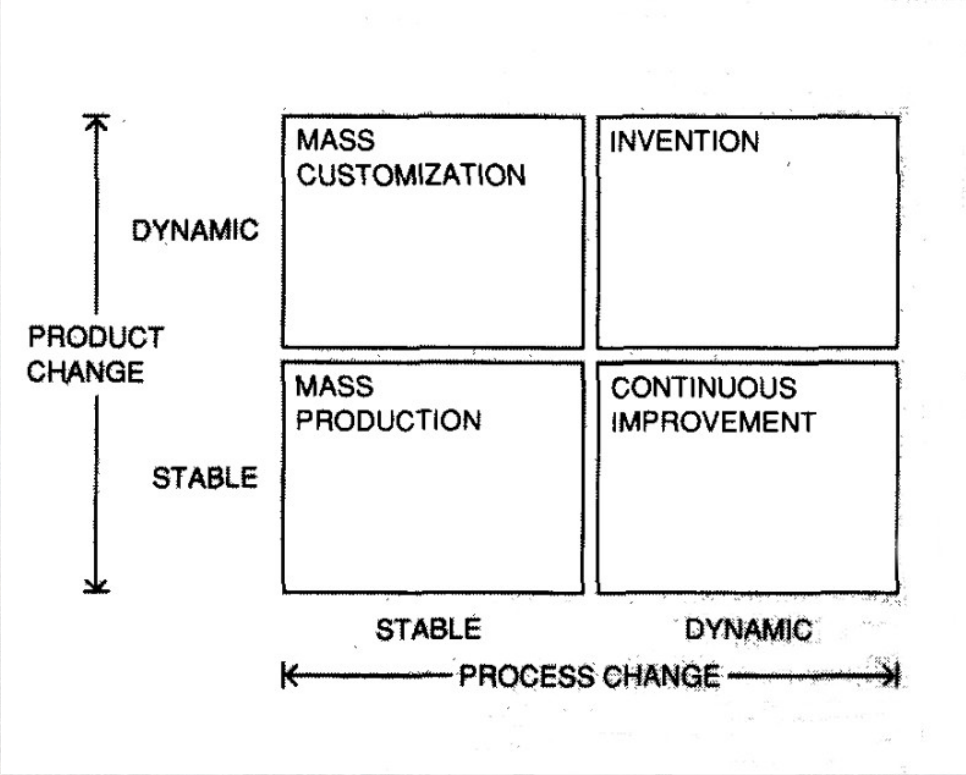


Figure 1: Product-process change matrix

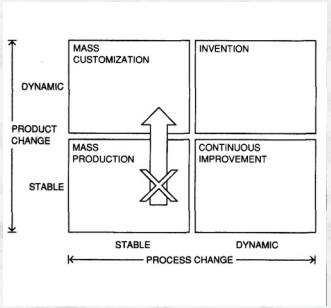


Figure 9
Making the transformation:
The wrong path

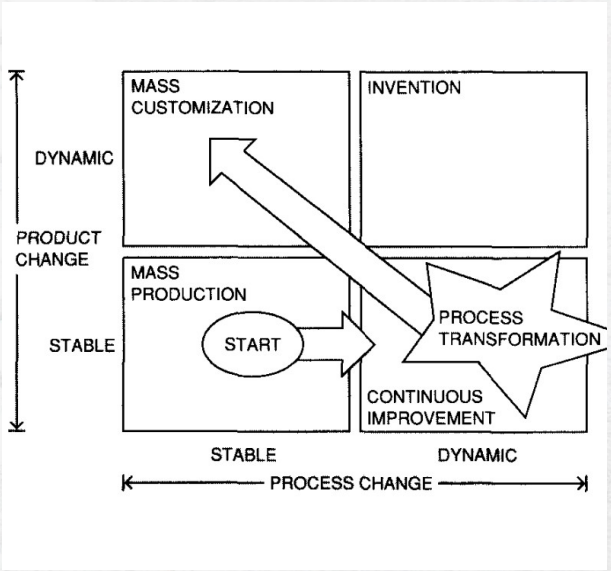
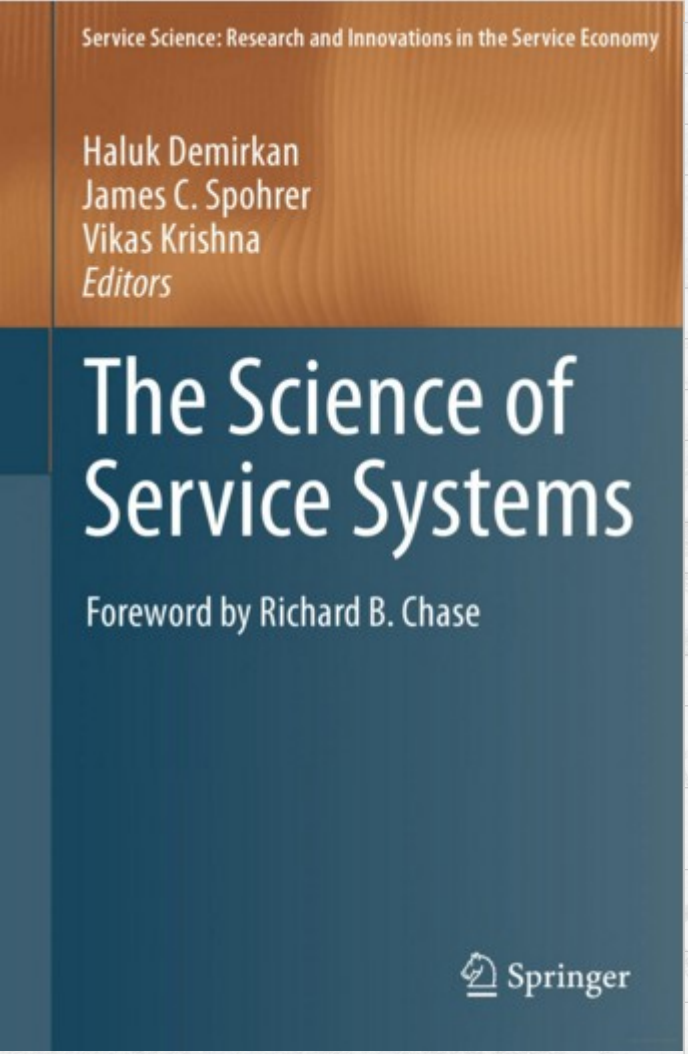
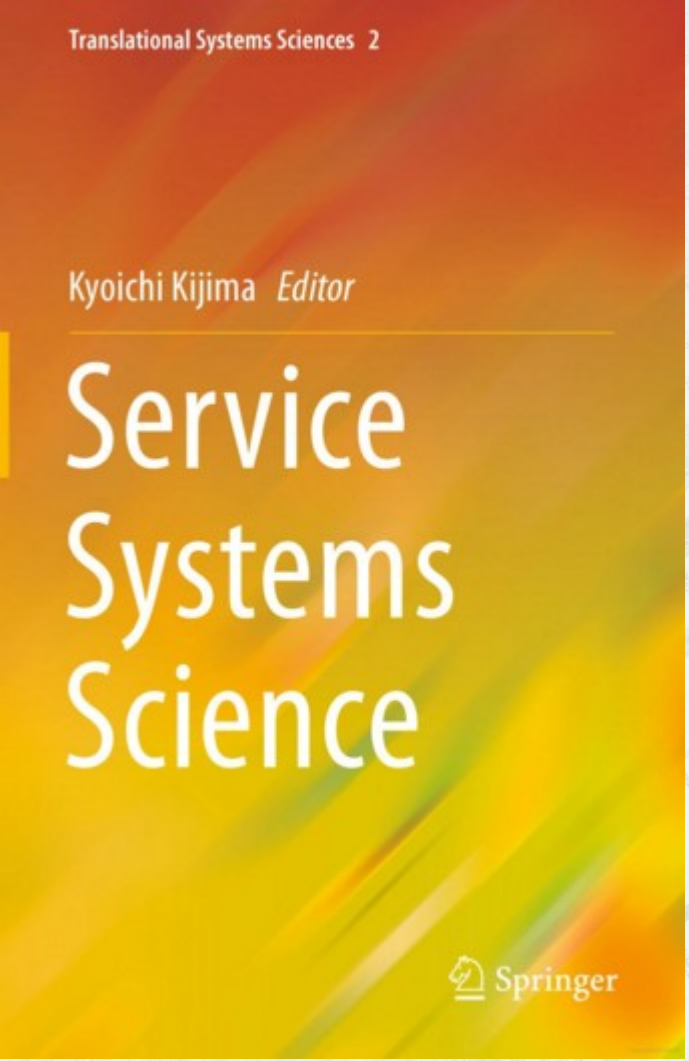


Figure 10
Making the transformation:
The right path

Boynton, Andrew C., Bart Victor, and B. Joseph Pine. 1993. “New Competitive Strategies: Challenges to Organizations and Information Technology.” IBM Systems Journal 32 (1): 40–64. https://doi.org/10.1147/sj.321.0040.



Introduction of the Science of Service Systems	Demirkan, Haluk (et al.)
Embedding the New Discipline of Service Science	Ng, Irene (et al.)
Key Dimensions of Service Systems in Value-Creating Networks	Mele, Cristina (et al.)
Making a Science of Service Systems Practical: Seeking Usefulness and Understandability while Avoiding Unnecessary Assumptions and Restrictions	Alter, Steven
Flexible Service Systems	Polyvyanyy, Artem (et al.)
Semantics for Smart Services	Petrie, Charles (et al.)
Designing Auctions for Coordination in Service Networks	Dinther, Clemens (et al.)
Service Systems Modeling: Concepts, Formalized Meta-Model and Technical Concretion	Böttcher, Martin (et al.)
Onto-ServSys: A Service System Ontology	Mora, Manuel (et al.)
A Framework that Situates Technology Research Within the Field of Service Science	Lyons, Kelly
Customer-Driven Value Co-creation in Service Networks	Kwan, Stephen K. (et al.)
Towards Service System Governance: Leveraging Service System Grammar to Empower Value Co-creation	Puehl, Stefan
Service Science: The Opportunity to Re-think What We Know About Service Design	Voss, Chris (et al.)
Service Science Learning: Exploring the Challenge of Cross Disciplinary and Academia–Company Collaboration	Lemmink, Jos G. A. M. (et al.)
An Engineering Perspective on Service Science	McFarlane, Duncan
Service Systems in Changing Paradigms: An Inquiry Through the Systems Sciences	Ing, David



Social Value: A Service Science Perspective	Spohrer, Jim (et al.)
Translational and Trans-disciplinary Approach to Service Systems	Kijima, Kyoichi
Service Artifacts as Co-creation Boundary Objects in Digital Platforms	Smedlund, Anssi (et al.)
Four Axiomatic Requirements for Service Systems Research	Reynolds, David (et al.)
Social Innovations—Manifested in New Services and in New System Level Interactions	Toivonen, Marja
The Limitations of Logic and Science and Systemic Thinking —from the Science of Service Systems to the Art of Coexistence and Co-prosperity Systems	Maeno, Takashi
Canadian Governments Reference Models	Wiseman, Roy
What Is 5S-KAIZEN? Asian-African Transnational and Translational Community of Practice in Value Co-creation of Health Services	Matsushita, Hiro
Creating Information-Based Customer Value with Service Systems in Retailing	Rintamäki, Timo (et al.)
Service R&D Program Design Aiming at Service Innovation	Sawatani, Yuriko (et al.)

Agenda

[preamble] Episteme, Techne, Phronesis (reordered)

- Intellectual Pursuits (Rethinking Systems Thinking)
- Systems changes as situated c.f. ideal-seeking

A. Value(s), Judgment, Soft Systems Thinking

- Appreciative Systems (Vickers, Checkland)
- Policy, impacts and consequences of systems changes

B. Service Systems (c.f. Production Systems)

- Science of Service Systems (Spohrer, Kijima)
- Material-products c.f. information-services as systems changes

C. Socio-Technical Systems Perspective

- Tavistock Institute + Legacy (Trist, Emery, Ramirez)
- Coproduction and design principles guiding systems changes

The Tavistock Institute developed three systems perspectives

[... the] socio-psychological, the socio-technical and the socio-ecological perspectives ... emerged from each other in relation to changes taking place in the wider social environment. One could not have been forecast from the others. Though **interdependent**, each has its own focus. Many of the **more complex projects require all three perspectives**. [p. 30]

Socio-Psychological Systems Perspective

... in Institute projects, the **psychological forces** are are directed **towards the social field**, whereas in the the Clinic, it is the other way around [with **social forces** directed **toward the psychological field**]. [p. 31]

Socio-Technical Systems Perspective

... the **best match** between the **social** and **technical systems** of an organization, since called the **principle of joint optimization**

... the **second design principle**, the **redundancy of functions**, as contrasted with the **redundancy of parts**. [p. 32]

Socio-Ecological Systems Perspective

... the **context** of the **increasing levels of interdependence, complexity and uncertainty** that characterize societies a the present time.

... new problems related to **emergent values** such as **cooperation** and **nurturance**. [p. 33]

Trist, Eric L., and Hugh Murray. 1997. "Historical Overview: The Foundation and Development of the Tavistock Institute to 1989." In *The Social Engagement of Social Science: The Socio-Ecological Perspective*, edited by Eric L. Trist, Frederick Edmund Emery, and Hugh Murray, 3:1–35. Philadelphia: University of Pennsylvania Press.

Socio-Technical Systems are seen as a perspective, not a theory, where the technological system is a whole in an environment

The first function of a socio-technical systems concept is as a frame of reference … ordering the facts. It directs attention to the following groups of problems as the focus of three main stages in the analysis of the enterprise:

- The **analysis** of the component **parts** to reveal **the way each contributes** to the performance of the enterprise and creates or meets the requirements of **other parts.** The first components to analyze are (**1**) **the technical** and (2) the "**work relationship structure**" and its occupational roles.
- The **analysis** of the **interrelation** of these parts with particular reference to the **problems of internal coordination and control** thus created.
- The **detection** and **analysis** of the **relevant external environment** of the enterprise and the way the enterprise manages its relation to it.

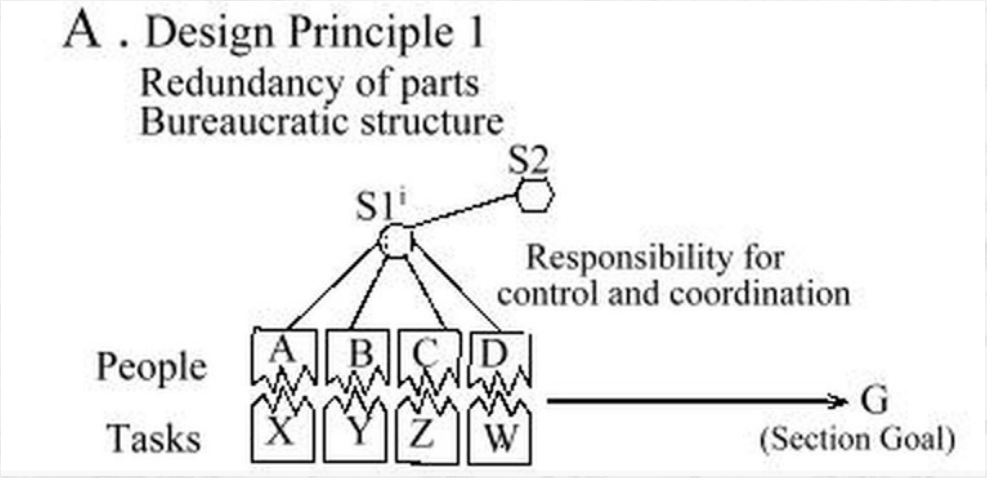
In its second function, the concept of socio-technical systems invoke a body of subordinate concepts and hypotheses to describe and explain the behavior of enterprises and their members. This function is strictly derived from the first. There is no single body of concepts that can claim to be the theory of socio-technical systems.

Trist and Bamforth (1951:5), in the first public usage of the concept of "socio-technical systems", made the common distinction between the "technological system" and the "social structure consisting of the occupation roles that have been institutionalized in its use."

So close is the **relationship** between the various aspects that the **social** and the **psychological** can be understood only in terms of the detailed **engineering** facts and of the way the **technological system as a whole** behaves **in the environment** of the underground (mining) situation.
(Trist & Bamforth, 1951:11)

Emery, Fred E. 1993. "Characteristics of Socio-Technical Systems." In *The Social Engagement of Social Science: The Socio-Technical Perspective*, edited by Eric L. Trist and Hugh Murray, 2:157–86. Philadelphia: University of Pennsylvania Press. http://moderntimesworkplace.com/archives/ericsess/sessvol2/sessvol2.html .

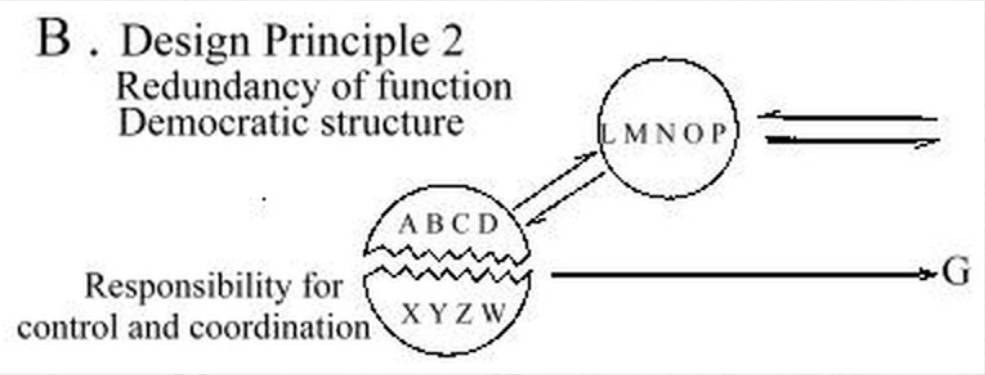
The Socio-Technical Systems Perspectives sees a alternative forms or organizing people, tasks and supervisors as DP1 and DP2



Model A defines the dominant bureaucratic form of organization also known as "scientific management." [….] The organizational module is the supervisor and his or her section, with responsibility for control and coordination …

It is based on the premise that **human beings** can be used as **redundant parts**. [….] In this structure there is little opportunity for decision making, learning or variety. [….]

But in this structure there will be an almost universal tendency to develop an "informal system"; one designed "to beat the system."



The alternative democratic organizational module has markedly different potentials. [….]

The **group** must share the tasks of **monitoring** and **controlling** the **contributions** of its own members and organizing their **mutual support** to cope with individual and task variations. They are now all **jointly responsible** for the achievement of G. [….] Individuals can negotiate an optimal degree of variety and autonomy for themselves and renegotiate it according to changing circumstances. [….]

These groups can be only "semiautonomous," or self-managing, not fully autonomous as they often were in cottage industry

Emery, Fred E., and Merrelyn Emery. 1993. “The Participative Design Workshop.” In *The Social Engagement of Social Science: The Socio-Technical Perspective*, edited by Eric L. Trist, and Hugh Murray, 2:599–613. Philadelphia: University of Pennsylvania Press. http://moderntimesworkplace.com/archives/ericsess/sessvol2/sessvol2.html .

For a socio-technical system, responding purposively to a wide range of conditions requires redundancy against failure to be designed in

In choosing their organizational designs, people do not confront an infinite range of choice. Far from it.

If their organizations are to be **purposive**, they have to be **adaptive** over a **wide range** of **evolving circumstances**. The alternative is some sort of servomechanism with a fixed repertoire of responses, capable of surviving only within a very narrow range of foreseeable conditions.

To achieve wide adaptiveness redundancy has to be built into the system. This is an important property, as with each arithmetic increase in redundancy the reliability of the system tends to increase exponentially (Pierce, 1964).

There are **two basic ways that redundancy can be built in**:

By **adding redundant parts** to the system. **Each part is replaceable**; as and when one part fails, another takes over.

The **first design** of redundant parts has been described … as the megamachine

By **adding redundant functions** to the parts. At any one time some of the functions of any part will be redundant to the role it is playing at the time; as and **when a part fails in the function it is performing, other parts can assume the function**; so long as a part retains any of its functional capabilities (i.e., functional relative to system requirements) it is of some value to the system.

The **second design** is characterized by them as complementary seriality, in which "the governing relation is symmetrical dependence. The sharing of parts is necessary to both of the parts. Neither part can survive separation"

Emery, Fred E. 1993. “The Second Design Priniciple: Participation and the Democratization of Work.” In *The Social Engagement of Social Science: The Socio-Technical Perspective*, edited by Eric L. Trist and Hugh Murray, 2:214–33. Philadelphia: University of Pennsylvania Press. http://moderntimesworkplace.com/archives/ericsess/sessvol2/sessvol2.html .

From socio-technical to socio-ecological systems, DP3 as *Redundancy of Potentialities* is proposed for transorganizational work

... the **transorganizational work system** contains multiple sources of **knowledge** about the **contextual environment** that may be strategy-relevant, and also because the realm of interactions that the system can leverage for strategic purposes is expanded. In effect, a work system designed so that this distributed knowledge can be brought to bear on the contextual environment expands the transactional environment and decreases the uncertainty that remains in the contextual environment accordingly.

What would such a re-framed design principle look like? The design requirements of situations ... for DP3 to be operative are as follows:

*First, the set of **actors** in a social field are **able to constitute and re-define that field**, not just function within it*. This includes the ability to enlarge the transactional part of the field, as discussed above.

*Second, a wide set of potential **inter-organizational connections** exist in the field and are imagined by some actors in it*. [….] DP3 extends the design criteria to building in the potential for relating and/or connecting with a broader set of entities in the field that are not yet linked and which may not be aware of each other.

*Third, at least one **value constellation spans across the boundaries** of two or more organizations in the field*. The actors in the field create a trans-organizational work system, ... designed to produce some output jointly.

..we call this feature of DP3 the **Redundancy of Potentialities** (RoP). It involves the actors' aspirations and fears of what the field that they constitute might become in its context and in relation to other fields.

We offer brief **illustrations** of DP3: DP3 concerning ''bazaar'' governance in the **open-source** software community; and **catalytic organizations** in institutional fields.

Selsky, John W., Rafael Ramírez, and Oğuz N. Babüroğlu. 2013. "Collaborative Capability Design: Redundancy of Potentialities." *Systemic Practice and Action Research* 26 (5): 377–95. https://doi.org/10.1007/s11213-012-9257-5 .

Computing, cognition and the future of knowing

How humans and machines are forging a new age of understanding

IBM

Dr. John E. Kelly III
Senior Vice President,
IBM Research and Solutions Portfol

The Cognitive Era (2011 –)

The potential for something beyond programmable systems was foreseen as far back as 1960, when computing pioneer J.C.R. Licklider wrote his seminal paper "Man-Computer Symbiosis." Much of modern computing is based on Licklider's research and insights:

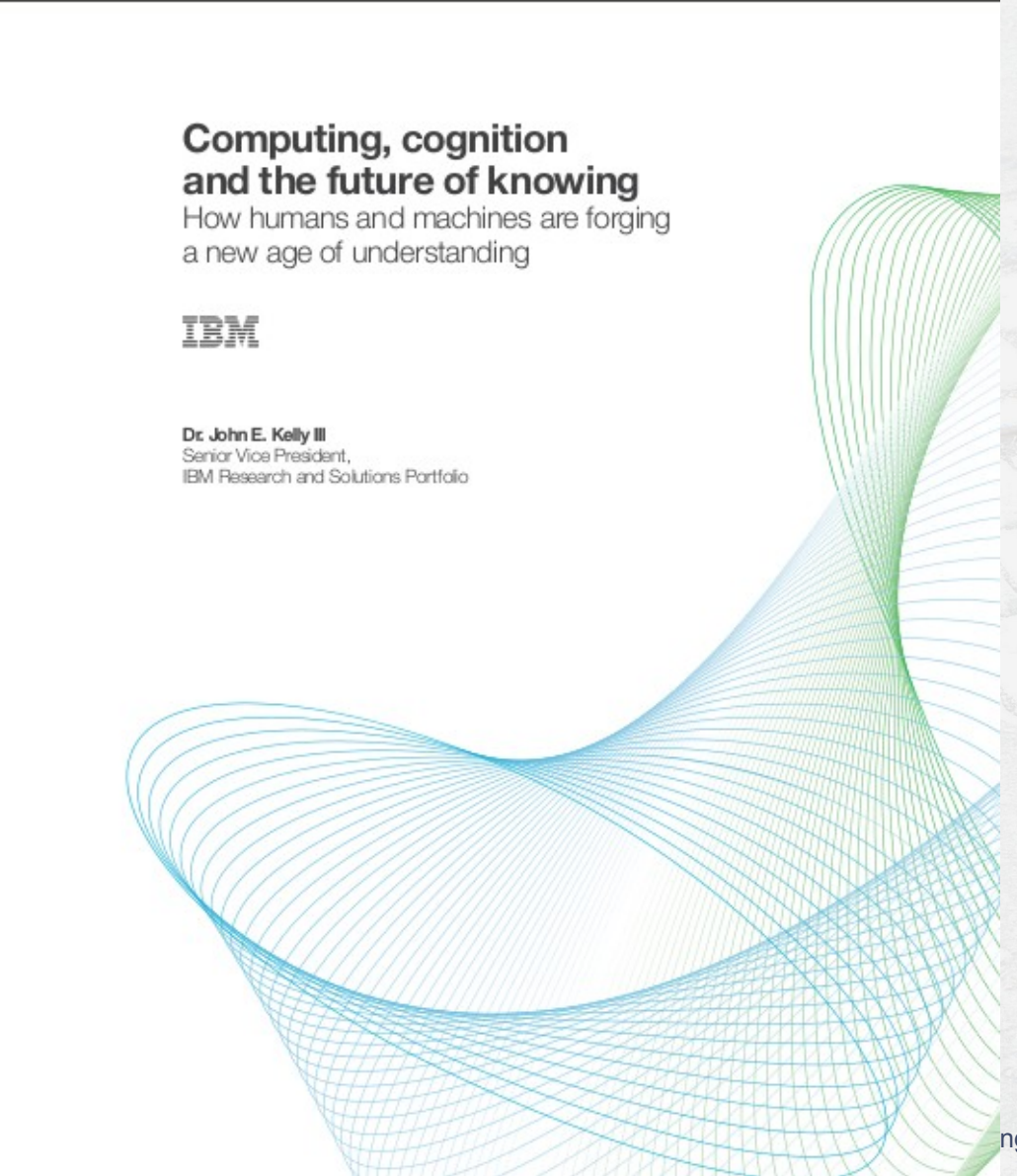
"Man-computer symbiosis is an expected development in cooperative interaction between men and electronic computers. It will involve very close coupling between the human and the electronic members of the partnership.

Image 1

The Tabulating Era (1900s – 1940s)

The Programming Era (1950s – present)

The Cognitive Era (2011 –)



Cognitive computing refers to systems that learn at scale, reason with purpose and interact with humans naturally. Rather than being explicitly programmed, they learn and reason from their interactions with us and from their experiences with their environment. […]

Those systems have been **deterministic**; cognitive systems are **probabilistic**. They generate not just answers to numerical problems, but hypotheses, reasoned arguments and recommendations about more complex — and meaningful — bodies of data.

From the 2015 Cognitive_Colloquium[SF], at http://research.ibm.com/cognitive-computing/#sf

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Agenda

[preamble] Episteme, Techne, Phronesis (reordered)

- Intellectual Pursuits (Rethinking Systems Thinking)
- Systems changes as situated c.f. ideal-seeking

A. Value(s), Judgment, Soft Systems Thinking

- Appreciative Systems (Vickers, Checkland)
- Policy, impacts and consequences of systems changes

B. Service Systems (c.f. Production Systems)

- Science of Service Systems (Spohrer, Kijima)
- Material-products c.f. information-services as systems changes

C. Socio-Technical Systems Perspective

- Tavistock Institute + Legacy (Trist, Emery, Ramirez)
- Coproduction and design principles guiding systems changes

Image CC-BY Mike Cassano (2009) *Most Interesting Pothole*