

Socio-Technical Systems

Introduction

- We have seen from previous lectures that systems can meet their technical requirements and still be deemed as failures
- Relationships between BP actors & system supporting the BPs are not properly considered in techno-centric approaches ([1,2])
- Many systems are not utilized because they conflict with other aspects of the user's job
- Study by Lucas [3] of over 2000 systems in 16 companies found:
"It is our contention that the major reason most info systems have failed is that we have ignored organisational behaviour problems in the design and operation of computer-based information systems."
- So integrating social & technical systems means a break from the past where social, technical aspects of work have been artificially divided.

“Theory X” V “Theory Y”

Where do such problems in the design arise from?

- Theory X (aka “Traditional/Mechanical View”)
 - Assumes worker likes order, tightly spec'd boundaries, averse to control over activities
 - Change strategy based around this creates highly structured, precise job defs, emphasizing order as necessary for efficiency
 - Sees workers as info consumers => sys probs = lack of right info!
- Theory Y (aka “HR Theory”)
 - Assumes worker is responsible, self-achieving person, taking full control over environment
 - Change strategy based around this creates a flexible orgn emphasizing self-direction with opportunities for personal growth

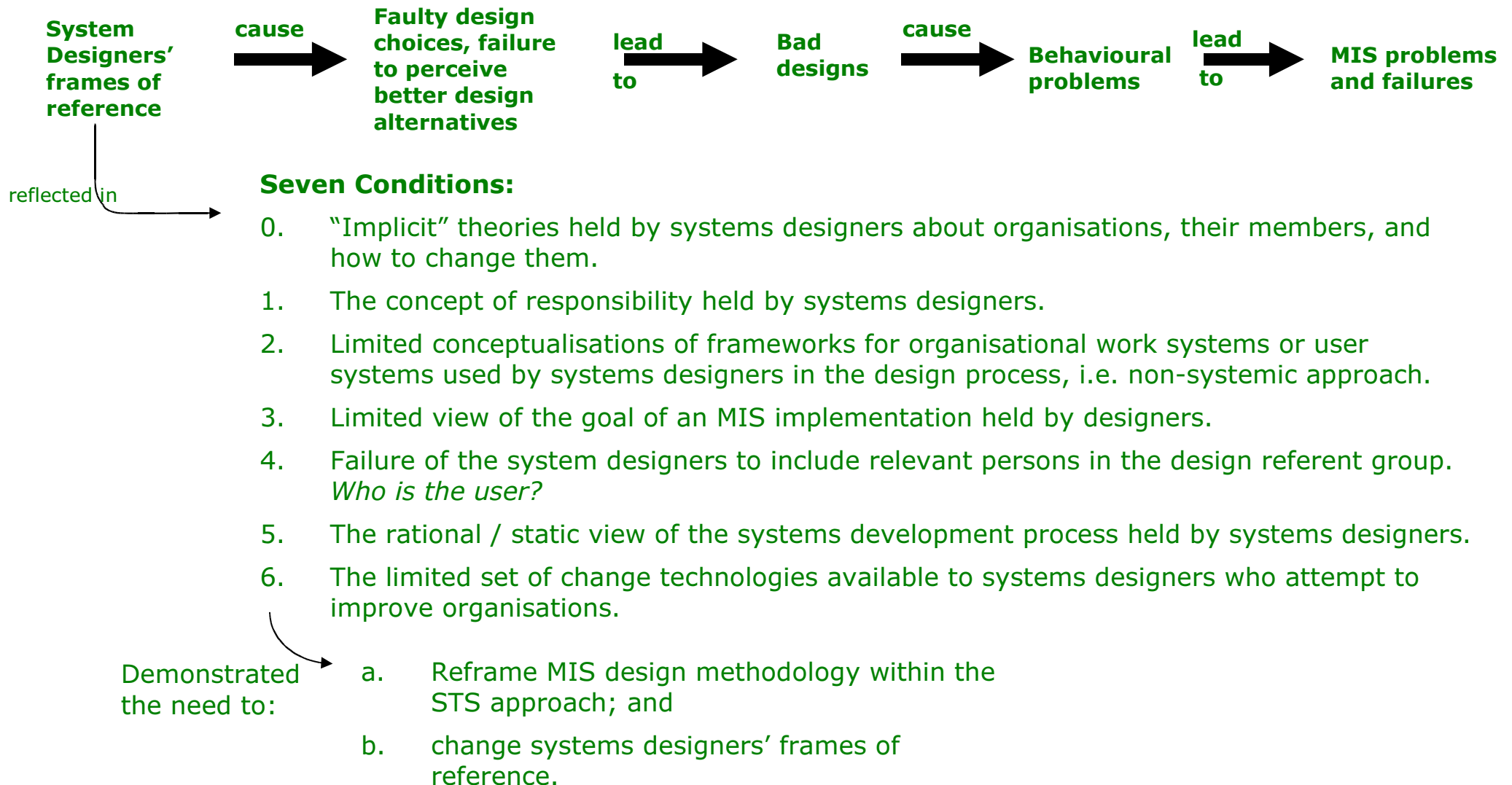
History of Socio-Technical Systems

- Term *Socio-Technical Systems* from the work of Emery and Trist [4] in context of UK Coal Industry at Tavistock Institute.
- Used it to describe systems with a complex interaction between humans, machines and the env aspects of the work system.
- Concluded that have to take into account all when developing such systems using socio-technical system design (STSD) methods.
- These methods are more like guidelines than the sorts of design methods that are usually associated with systems engineering.
- STSD methods provide advice for systems designers rather than detailed methodologies that should be followed.

What is a Socio-Technical System?

- Although the term socio-technical systems is loosely used to describe many complex systems, five key aspects determine a socio-technical system [5]:
 - 1 The system has interdependent parts.
 - 2 The system adapts to and pursues goals in external environments.
 - 3 The system has an internal environment comprising separate but interdependent technical and social subsystems.
 - 4 There is choice in the system, e.g. system goals achievable by more than one means.
 - 5 System performance depends on jointly optimising the technical and social aspects of the system.

Rationale for Socio-Technical Design Methodology (Bostrom & Heinen [6])



Munkvold's Principles of Socio-Technology [7]

- Joint optimisation of Social & Technical system takes into account the following:
 - Social Aspects
 - + Attributes of people (attitudes, skills, values, etc.)
 - + Relationships among people
 - + Reward systems
 - + Authority structures
 - Technical Aspects
 - + Processes, tasks, technology
 - Optimisation of one at the expense of the other is sub-optimal
- Sociotech particularly considers the importance of
 - + Quality of Work Life
 - + Participation
 - + Semi-autonomous work groups

Quality of Work Life

- Historically only included:
 - + Wages
 - + Hours
 - + Physical conditions.

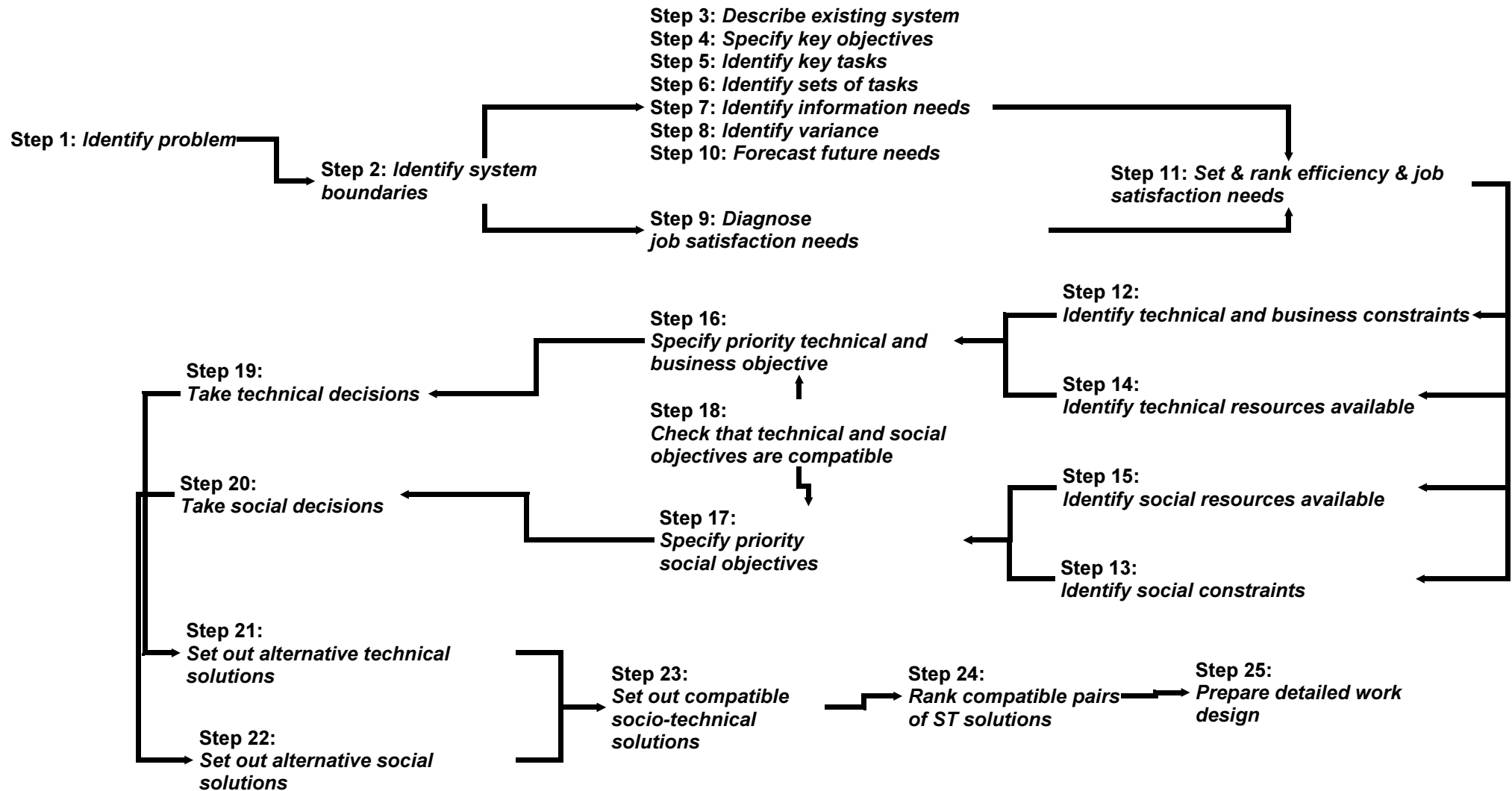
- These are still included, but it includes other concerns eg:
 - + Meaningful and satisfying work
 - + Control and influence over activities in Process engaged on
 - + Opportunities for Life-Long Learning (not just for employability but also for: social inclusion, citizenship and personal development)

- Working definition: involves an interesting, challenging and responsible job as perceived by the job holder

Mumford – ETHICS [10]

- (Effective Technical and Human Implementation of Computer-based Work Systems)
 1. Essential systems analysis
 2. Socio-technical systems design
 3. Setting out alternative solutions
 4. Setting out compatible solutions
 5. Re-working socio-technical solutions
 6. Preparing a detailed work design
- All done with the objectives of:
 1. Encourage participation
 2. Improve the general conditions of work
 3. Produce systems that are “technically efficient & have social characteristics leading to high job satisfaction”
 4. Follow the ST philosophy of trying for joint optimisation

Stages of the ETHICS Methodology [9]



Mumford – ETHICS [10]

- Specifies the formation of two design teams, focussing on technical & social design.
- Facilitator used to overcome obstacles related to:
 - + lack of trust,
 - + conflicts of interest,
 - + time pressure and stress
 - + low morale on the part of the change team
 - + communication gaps
- Not increasing Quality of Work Life at expense of economic efficiency – increased QWL will increase quality and efficiency.

Criticisms of Socio-tech (Munkvold [7])

- Emphasis on balance, consensus ignores orgn'l politics
- Participative design will only function when employee numbers are small
- STS only works in small, mainly manufacturing operations
- Or even:
 “Socio-Technology has a whiff of communism about it!”

STS Case Study

- Kochan & Gershenfeld [11] looked at STS in Auto Industry
- GM imitated Toyota's methods of manufacturing cars.
- Total of \$50Bn spent over 10 years without any obvious change
- Lesson: can't simply automate way to high productivity & quality.
- Diffs:
 - + US engineers separated the hardware and human features of technology and saw them differently.
 - + They saw human features as "unpredictable variance that should be minimized" .
 - + In Japan, technology embodied both h/w and human features.
 - + It was sometimes referred to as "human ware" and humans were seen as "not a source of error variance but as a force for giving wisdom to the machines" .

STS Case Study (cont'd)

- Toyota, GM set up new org in a GM plant in California (NUMMI)
- This was done in order for both companies to learn;
- Toyota wanted to see if a "US workforce and a US supply base could support the Toyota Production System (TPS)" .
- GM wanted to learn more about Japanese production system
- Californian plant was picked as it had a bad reputation in terms of productivity, quality and labour relations.
- Plant had Toyota's mgmt, production system, the same union leaders, mostly same workforce and the same technology.
- In 2 years was most productive, high-quality US auto producer
- Finding that plants which "integrated flexible automation with flexible work systems and supportive human resource practises" produced higher productivity and quality.

STS & Other Process Change Methodologies: BPR & STS

Similarities:

- (re)design of business processes
- Use of semi-autonomous teams
- Empowerment

Differences:

- Radical change (BPR) vs. continuous change (STS)
- Purpose of team-building and empowerment in BPR is to support business goals, rather than to improve quality of work life.
- While re-engineering has led to improvements in performance, it has failed to produce the number of highly-motivated employees needed to ensure consistently high-performing organisations.

STS & Other Process Change Methodologies (cont'd): Total Quality Management (TQM)

Key principles of TQM:

- + Customer focus
- + Focus on work processes
- + Use of cross-functional teams
- + Employee involvement
- + Self-management
- + Analysis of variability
- + Benchmarking
- + Learning and continuous improvement

Focus on empowerment of TQM conflicts with strong focus on top-down implementation.

Comparative Strengths of TQM & STS

Provides a standardized system for measuring and tracking improvement.

Assures that efficient practices learned by one team will be implemented by other teams.

Establishes the goal of continuously improving current work processes.

Develops a common goal of quality improvement.

Focuses on coordination of multiple work processes.

Provides a flexible structure that encourages adaptation to a changing environment.

Assures that individuals and teams have the freedom to learn by exploration.

Establishes the goal of discovering new methods for accomplishing work.

Develops employee psychological ownership of work.

Focuses on innovation through diversity of inputs.

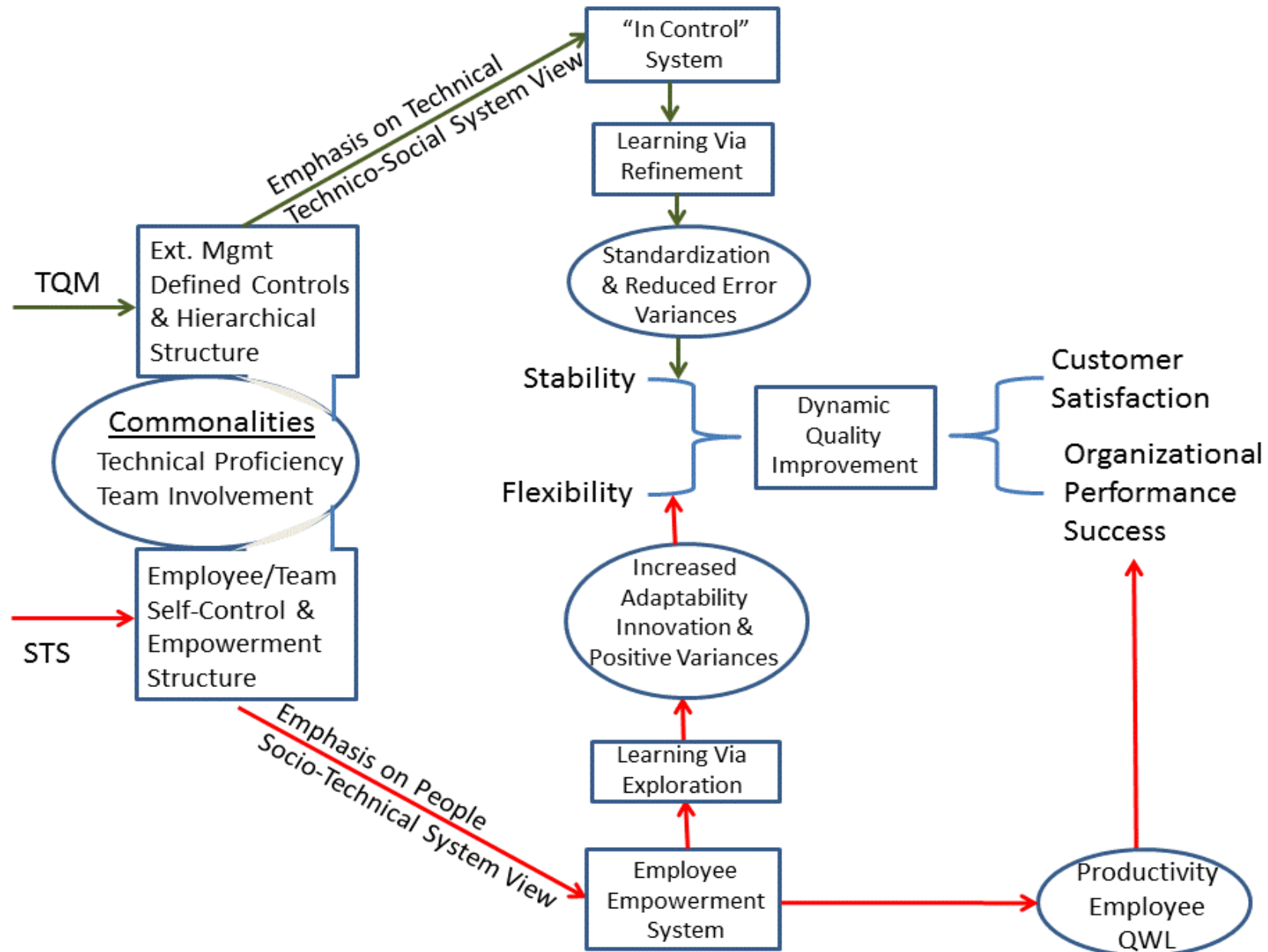
Incorporating TQM & STS

- Have seen from Munkvold [7] the criticisms of STS
 - + Only functions when employee numbers are small
 - + STS only works in small, mainly manufacturing operations
 - + Etc etc
- TQM has also been criticised:
 - + Guidelines too abstract: only gifted leaders can deploy successfully
 - + Business magazines and newspapers reported failure of TQM efforts.
 - + Low success probability deterred many orgs from trying TQM.
 - + Often ignored in favour of more structured ISO 9000
- Manz & Stewart [12] have advocated the use of combined STS/TQM approach:
 - + Both advocate some degree of technical ability, employee involvement
 - + TQM, STS widely recognized and utilized approaches to work design
 - + Potential synergies to be gained from central elements of both?

Incorporating TQM & STS (cont'd)

- Similarities/Complementarities:
 - + Both supplementary (creating same BPs, desired outcomes) and complementary (providing unique and significant contributions)
 - + Combination holds promise?
- Examples of this:
 - + STS calls for technical efficiency, error variances reduction as an essential component of social empowerment based work system design.
 - + But TQM takes technical a step further by providing a system of interrelated methods and principles for achieving these efficiencies.
 - + Most TQM programs advocate employee involvement, but stop short of establishing a highly empowering work environment.
 - + But STS provides the potential for adding this to TQM and so helps the org better adapt to shifting customer demands

Incorporating TQM & STS (cont'd) [12]



21st Century: Growing Role for STS

- New challenges for orgs in “these uncertain economic times”
- New Technologies may have to be implemented to increase and maintain an org's output (Big Data/Big Computing/SOAs)
- The way that employees interact with each other or react to such new tech or social media is increasingly unpredictable
- As a result systems that can handle non-deterministic and emergent properties in an org are necessary
- There is evidence of increasingly more complicated relationships on the part of workers with org objectives
- This is especially true in high-value sectors where niche skills are much sought-after (e.g. coding in particular languages)

21st Century: Growing Role for STS (Cont'd)

New organisational forms have become fashionable, e.g.:

- + virtual organisations
- + dynamic networks

Key characteristics in common

- + Focus on BPs instead of traditional functional organisation
- + Focus on team organisation
- + Decentralised decision-making
- + IT as an important enabler
 - + Sometimes deflects attention from other important org factors such as power and authority.
 - + Deployment is easy but sometimes adoption not always so!

For STS to remain relevant, must contribute in env in which flexible, multifunctional ICT Systems are implemented into existing operational work systems

Future Research in the Area of STS design

- Scaachi [13] looked at likely Future Research in STS:
 - STS -> Socio-Technical Interaction Networks (STINs)
 - + STINs consist of people, resources, org policies & institutional rules
 - + These embed/surround/interact with an IS and each other
 - + STINs aim to mobilize these to the evolving needs of a user
 - + Focus on Systems Design as system-centric or user-centric muddies where system boundary lies. Who is user of what? => user participation?
 - STS in Developing Work Practices
 - + Sees evolution away from prescriptive remedies towards collective work practices that can be easily adopted.
 - + Aligns with the paradigm of *Network Enabled Capability* (NEC) [14]
 - + Org deals with ext chaos by reducing int control/coordination needs.
 - + This option might be called the strategy of 'simple organisations and complex jobs'

Future Research in STS (cont'd)

- Walker, Creanor [15] applied STINs to Networked Learning (NL)
 - + Learning is increasingly complex due to tech devpts (Web 2.0, social n/w), changing policies, skill requirements, need for flexible learning env.
 - + NL encompasses pedagogy, social, technical and cultural forces and so provides a good fit for STINs
 - + NL participants can come diverse backgrounds where with a range of occupational, domestic or ST networks and practices.
 - + If these local contexts are STINs, then design of NL is about linking together these STINs to enable learning i.e. a 'network of networks'.
 - + NL is an exercise in 'heterogeneous eng', with people and technologies organised through pedagogic practices and artefacts.
 - + In NL discontinuities between participants' local STINs can be thought of as boundaries, using different software; languages etc
 - + All such variables are necessarily time dependent.

Future Research in STS (cont'd)

- Scaachi [16] looked at STS in Open Source Software (OSS) devpt
 - + In this socio-technical world, the boundary between software developers and users is blurred, highly permeable, or non-existent.
 - + Entails devpt of constructive social relationships, informally negotiated social agreements, and a commitment to participate in SD through sustained contribution of software discourse.
 - + Participation in SD, system requirements, or design decision-making is by effort, willingness, prior experience, not assigned by mgmt authority.
 - + Also "source code" openness enables many forms of SD transparency, access, customization to suit user/developer in a site or installation.
 - + As participation in evolution of free/OSS is voluntary or self-selection those involved quickly evolve ways to collaborate to minimize indiv effort while maximizing collective accomplishment.
 - + Communities/systems success visible in growth of diverse applications as Apache, Squirrel Mail, Linux operating system, Mozilla web browser etc

Conclusion

- Technical solutions to MIS Problems only lead to more problems or wasted resources.
- Applications of change methods incorporating a Socio-Technical Systems (STS) approach can help here.
- One such the methodology is Mumford's ETHICS
- Takes into consideration both the Social & Technical in coming up with potential solutions to a problem.
- Can help to improve metrics e.g. QWL, customer satisfaction etc
- STS approach has similarities to BPR & TQM
- Possibilities of blend to combine their complementarities
- STS has more potential in future with growth in need for flexible systems and adaptive team members.

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