# Lean Production and Modern Socio-Technology (MST)

## Design principles compared: MST as the science of lean?

# OST and MST

Old sociotechnology (OST/Tavistock Institute) :

- Its origin: the Durham case
- Its ideas and tools: joint optimization and the variance matrix

According to De Sitter, OST is correct in its practice, but needs improvement of both

- Concepts and theories and
- Design tools (rules and instruments)

Modern sociotechnology: system-theoretical reformulation and transformation of OST

# Lean Production

LP: developed by Toyota Motor Company, so – again – organizational practice as the source, not of a problem but of a solution

Our task as Organization Design specialists:

1. To assess its success as a manufacturing strategy
2. To generalize it by embedding it in more abstract concepts
3. To re-specify it for non-manufacturing contexts

# Generalization

Lean Production as a design approach in search of a scientific foundation

1. Operations Management:
   - Factory Physics (Hopp and Spearman)
   - Theory of constraints (Goldratt)

2. System Theory: MST as the science of lean?

# Re-specification

The same idea applied in different contexts: lean/socio-technical factories, offices, hospitals, home care agencies, public services, schools and universities

The general idea: you re-specify according to the nature of the organization’s primary process or core technology

1. Long-linked, such as car manufacturing
2. Mediating, such as financial services
3. Intensive, such as health care and education

That is where Christensen comes in

# Business models in health care

Disruptive innovation: innovation of your business model

- Not technological: GM was disrupted by Toyota with non-technological means
- Linked to the nature of your primary process or core technology

Health care will/should be disrupted by three different business models:

1. Solution shop: intensive core technology
2. Value-added process business: long-linked core technology
3. Facilitated network: mediating core technology

# MST as science of lean

A reformulation of lean in sociotechnical terms, that is, in terms of the parameters of the production and control structure. The level of

1. Functional concentration
2. Functional differentiation
3. Function specialization
4. Separation of performance and control (regulation)

If successful, then lean embedded within more general theory

# Lean and MST

Lean, looked at

- From a design, not a change management perspective
- From a structural perspective (the way processes are structured or organized)

The structural (MST) perspective is based on

- Ashby: the law of variety
- Simon: The architecture of complexity
- Thompson: Organizations in action

# The grandfathers of MST

- Ashby: reduce the variety of disturbances and amplify the variety of the regulator
- Simon: decompose the system into subsystems with high internal and low external interdependencies (the principle of modularity or recursion levels as in the VSM)
- Thompson: you decompose by placing interdependent operations in the same unit in order to replace inter by intra unit coordination (and so economize on coordination costs)

# Levels of grouping

| | Macro | Meso | Micro |
|---|---|---|---|
| Pooled | X | X | |
| Sequential | | X | |
| Reciprocal | | | X |

Macro: independent parallel **value streams** (pooled)

Meso: segments or manufacturing cells within streams (pooled or sequential)

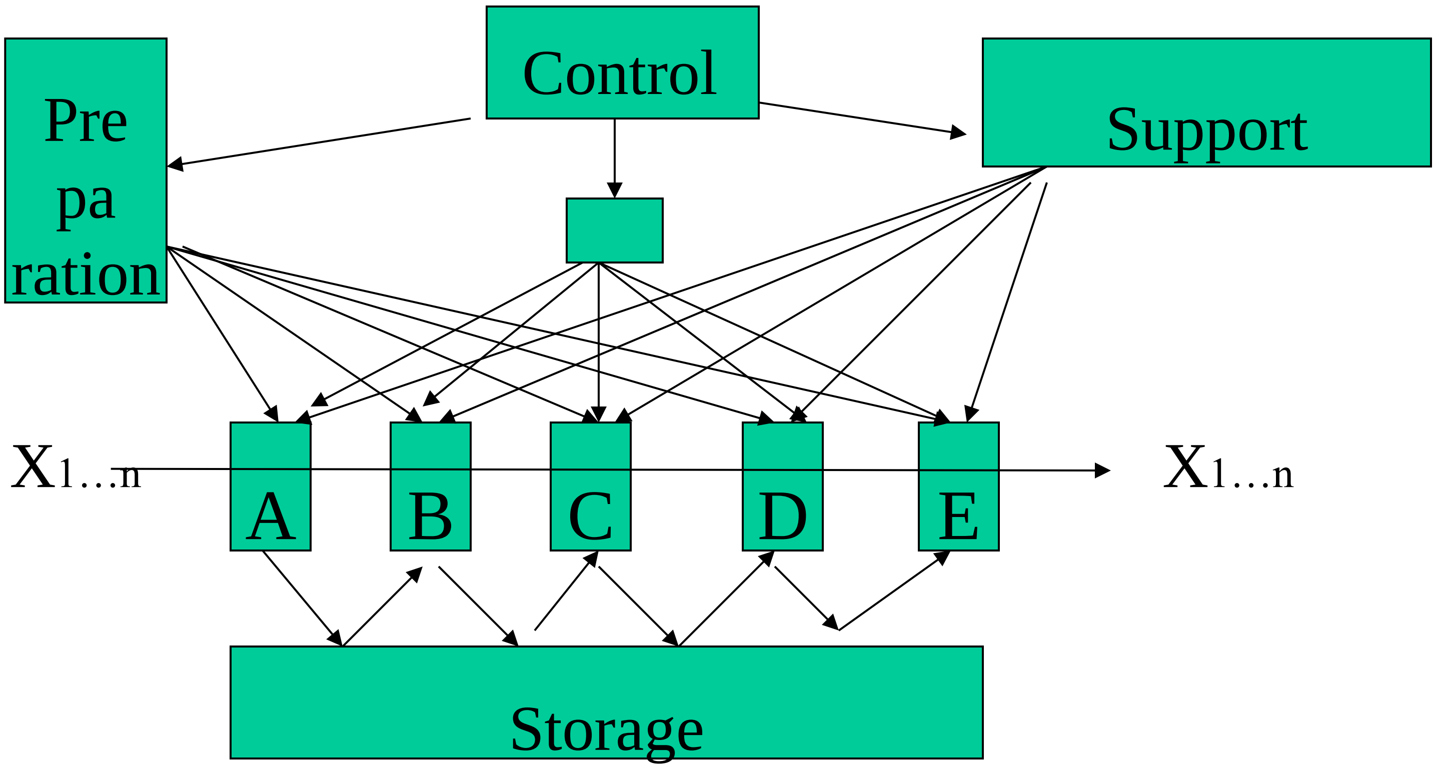
Micro: local teams with high internal and low external interdependencies

# Ways of grouping

Primary process: transformation of requested orders (a customer with a wish) in delivered orders with the help of activities/operations

1. Functional: similar activities (coupled to all orders)
2. Market- oriented: similar orders (coupled to different, interdependent activities)
   - Product families (product-based)
   - Customer families (customer-based)
   - Project families (project-based)

# Functional batch and queue structure



# 1. Create independent value streams

Substitute market-oriented for functional grouping

“The best way to think about a value stream is as a business segment focused on a product family, or sometimes, customer family. There is probably nothing more effective, in process improvement, than breaking up the functional silo’s and realigning the processes by the work flow in a product family. The work cell is a microcosm of this realignment. The focused factory and plants-in-a-plant are enlarged variants” (Schonberger 2008: 106).

See also Black, Hunter (2003) Lean manufacturing systems and cell design. (How to make streams, segments and teams?)

# 2. Decentralize preparation and support

Three subtypes of transformations: preparation, making and support

Integration: each value stream its own preparation and support

> “Notice that each cluster (focused factory) has its own staff of engineering (manufacturing, quality, design), maintenance and material support” (Nicholas, Soni 2006: 195).

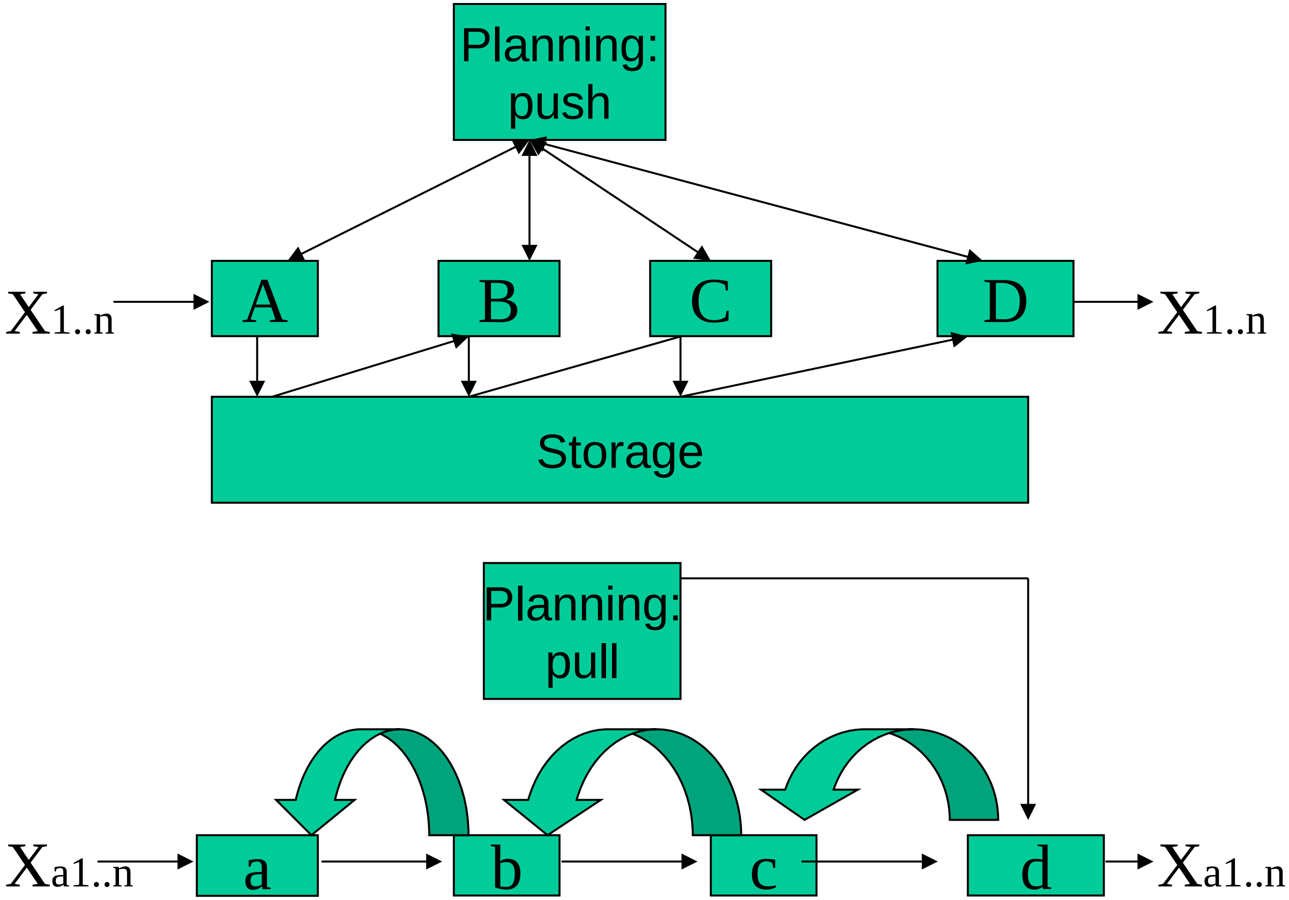
> QRM: the crossfunctional office cell

# 3. Integrate performance and control

Cells are multi-skill (cross-training) and responsible for the integral control of all aspects on the operational level of the control structure

“Operators in work cells typically have autonomy to make decisions and perform their own basic equipment maintenance, changeover, quality control, and job-scheduling (and) also engage in continuous improvement efforts, data collection and performance management, and even materials procurement from vendors” (Nicholas, Soni 2006: 79).

# 4. Replace push by pull planning



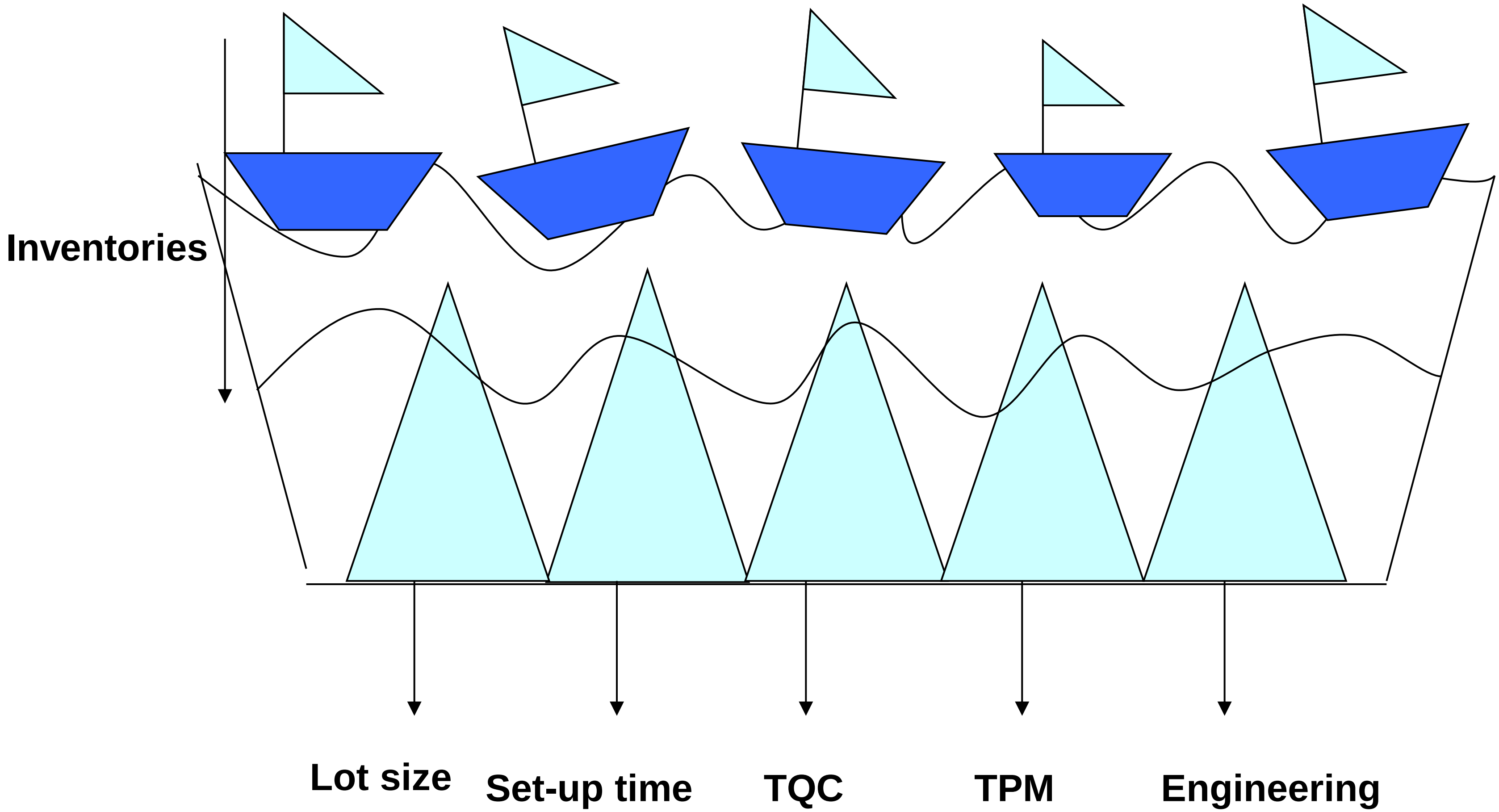
# The dangers of JIT

No protection by inventories, so to avoid waiting time in a flow structure you need

- Zero lot size
- Zero set-up time
- Zero material handling (and storage space)
- Zero defects
- Zero machine downtime
- Zero surging (leveled production)

Without continuous improvement you fail

# The necessity of continuous improvement



# 5. Continuous improvement

## Standardization and routines

- American system: of parts
- Taylor: of work (separation conception and execution)
- Lean: difference between ‘standard work’ and ‘work standards’:

“Whereas the former relies mostly on the efforts of shop floor teams to *develop* standards, the latter *imposes* standards that are developed by staff specialists and engineers. … Standard work represents the best ideas a team can generate at the time; it is the current ‘gold standard’” (Nicholas, Soni 2006: 164-165)

# Similarities

The Japanese strategy resembles the MST design strategy:

1. Reduce the complexity of the production structure by creating independent streams in order to reduce V(D)
2. As a necessary precondition for the decentralization of the control structure in order to enhance local V(R)
3. And then design simplified systems for
   - Planning (Kanban, Polca, Conwip, workload control)
   - Accounting (lean accounting)
   - And so on

# Routines

Routines: you discover the best way of doing things which then becomes your way of doing things

The difference between personal and organizational routines

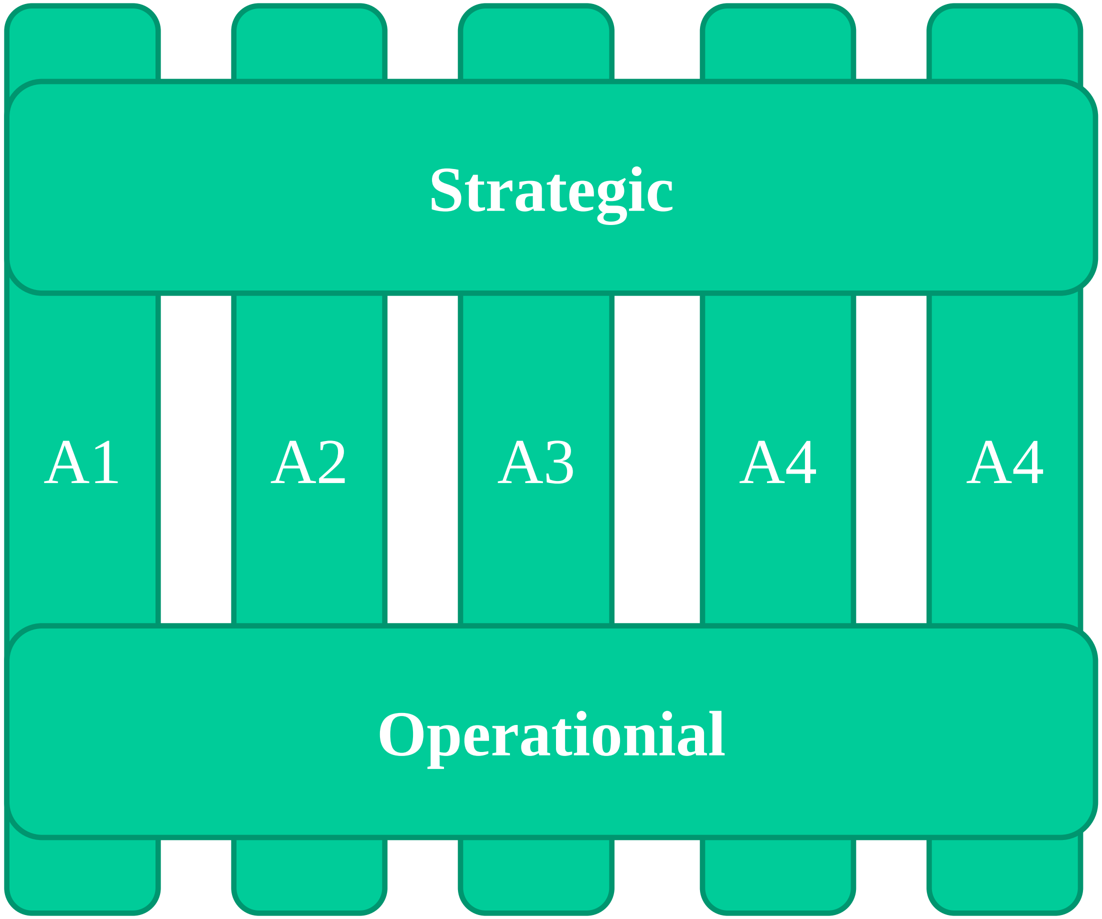
The function of personal routines

1. They economize on attention
2. Make deviations visible
3. Enable continuous improvement and learning

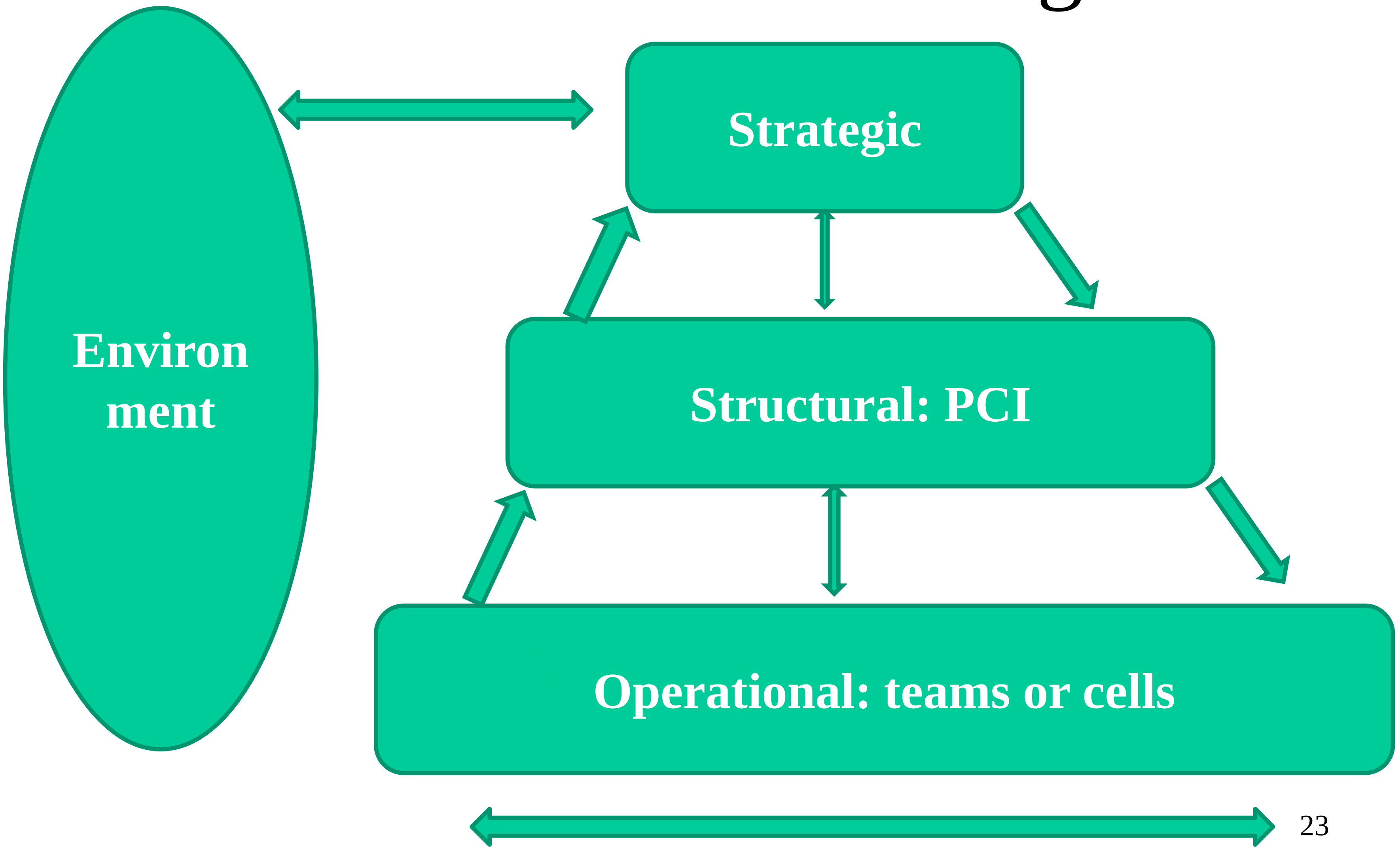
The danger: when they become ‘frozen habits’

The same with organizational routines

# Control structure: on aspects



# Control structure: integral



# Adapt system: push and pull

Push: you control output by regulating input. You anticipate on an uncertain future: cause controlled regulation

Pull: you control WIP by regulating output. You react to the actual process state: error controlled regulation

JIT: production is authorized by next station and needs flow

"Virtually all the benefits of JIT are a direct consequence of low WIP levels (e.g. short cycle times) or spurred by the pressures low WIP levels create" (Hopp, Spearman)

# Adapt systems: cost accounting

De Sitter on cost accounting in a functional structure: “each workplace and department consumes costs in relation to all products or services produced in an ever varying mix” (49).

- Costs are invisible: wrong decisions
- Costs are uncontrollable: no realistic control information

Alternatives

- Lean accounting: Stenzel (Ed.) 2007
- Beyond budgeting: Hope, Frazer 2003

# Literature


Hopp, Spearman (2008) Factory physics. Third Edition

Schonberger (2008) Best practices in lean six sigma process improvement (and earlier books)

Standard, Davis (1999) Running today’s factory

Nicholas, Soni (2006) The portal to lean production

Black, Hunter (2003) Lean manufacturing systems and cell design

Levinson, Rerick (2002) Lean enterprise: a synergistic approach to minimizing waste

Levinson (2007) Beyond the theory of constraints

Seddon (2005) Freedom from command & control

Seddon (2008) Systems thinking in the public sector

Stenzel (Ed.) (2008) Lean accounting

Hope, Fraser (2003) Beyond budgeting

# Economies of scale

Large batches enable amortization of set-up times over many parts: economizes on set-up times

Functional grouping enables

- Specialization of work (deep division of labour): economizes on wage costs (Babbage principle)
- Maximization of capacity utilization (of both machines and workers): economizes on idle machine and working time

Shop floor workers: perform one specialized operation on many different orders

# Diseconomies of scale

Large lot production in functional departments disrupts the smooth and continuous flow of parts through the factory

1. Creates excess inventories of WIP
   - At the machines
   - Between the departments
2. Causes high coordination costs
   - Big overhead
   - Complex planning

# 1. Effects of excess inventory

1.1. Effects on costs

- Capital tied up in inventories
- Large storage space
- Much material handling
- Risks of obsolence

1.2. Effects on quality: late discovery of defects, so

- A lot of rework and scrap
- Impedes root cause analysis

1.3. Effects on cycle time

- Long (mean) cycle time (processing plus waiting time)
- High variability of cycle time (standard deviation)

# 2. Coordination costs

General rule (Mintzberg): deep division of labour creates coordination costs (and lowers quality of work)

2.1. Centralized staff (overhead costs)

2.2. Proliferation of lateral linkages

2.3. Complex planning (computerized push systems)

2.4. Complex cost accounting (of overhead costs)

2.5. Monitoring on wrong performance criteria (optimizing functional departments sub-optimizes overall performance)