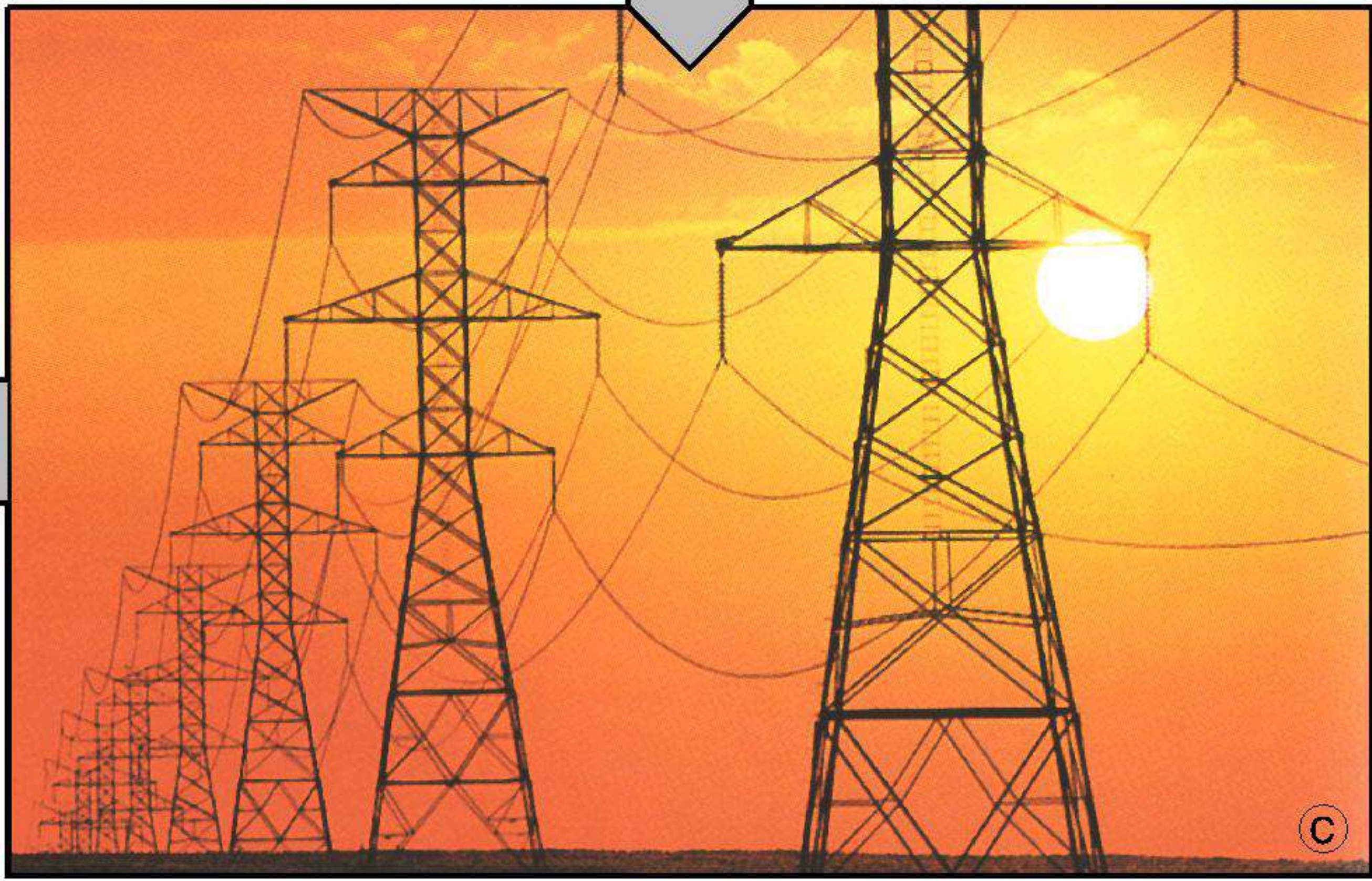
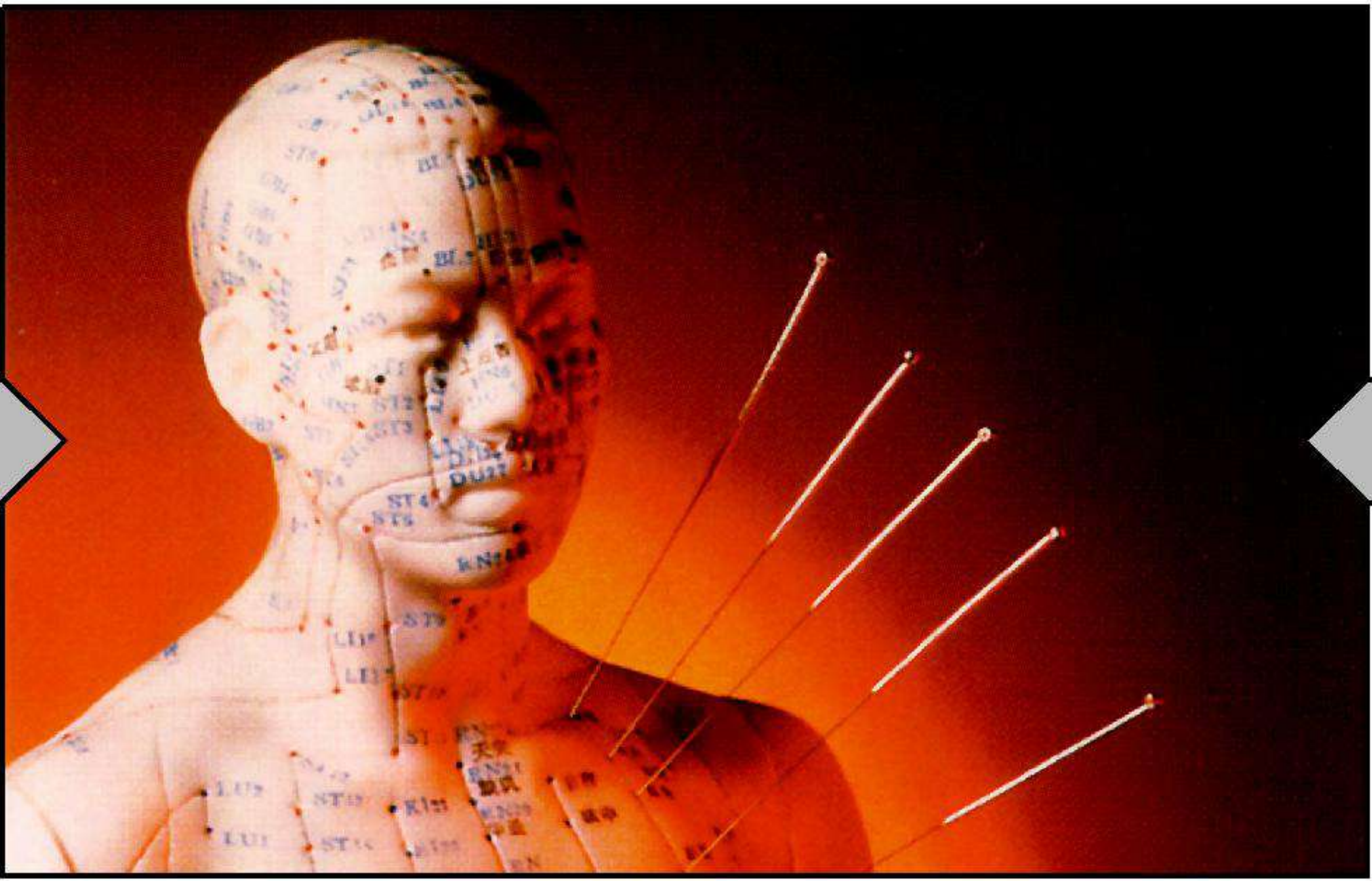
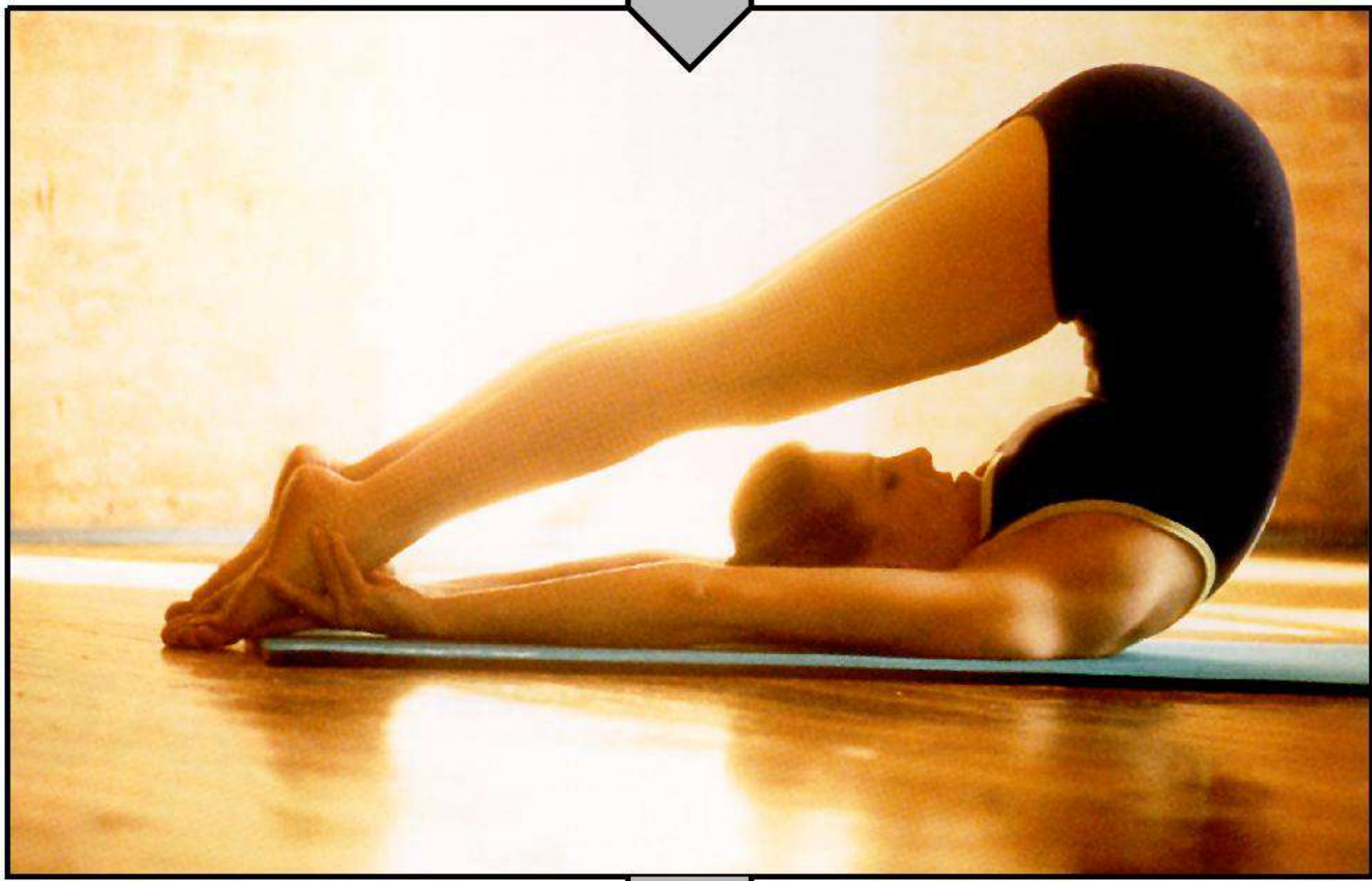
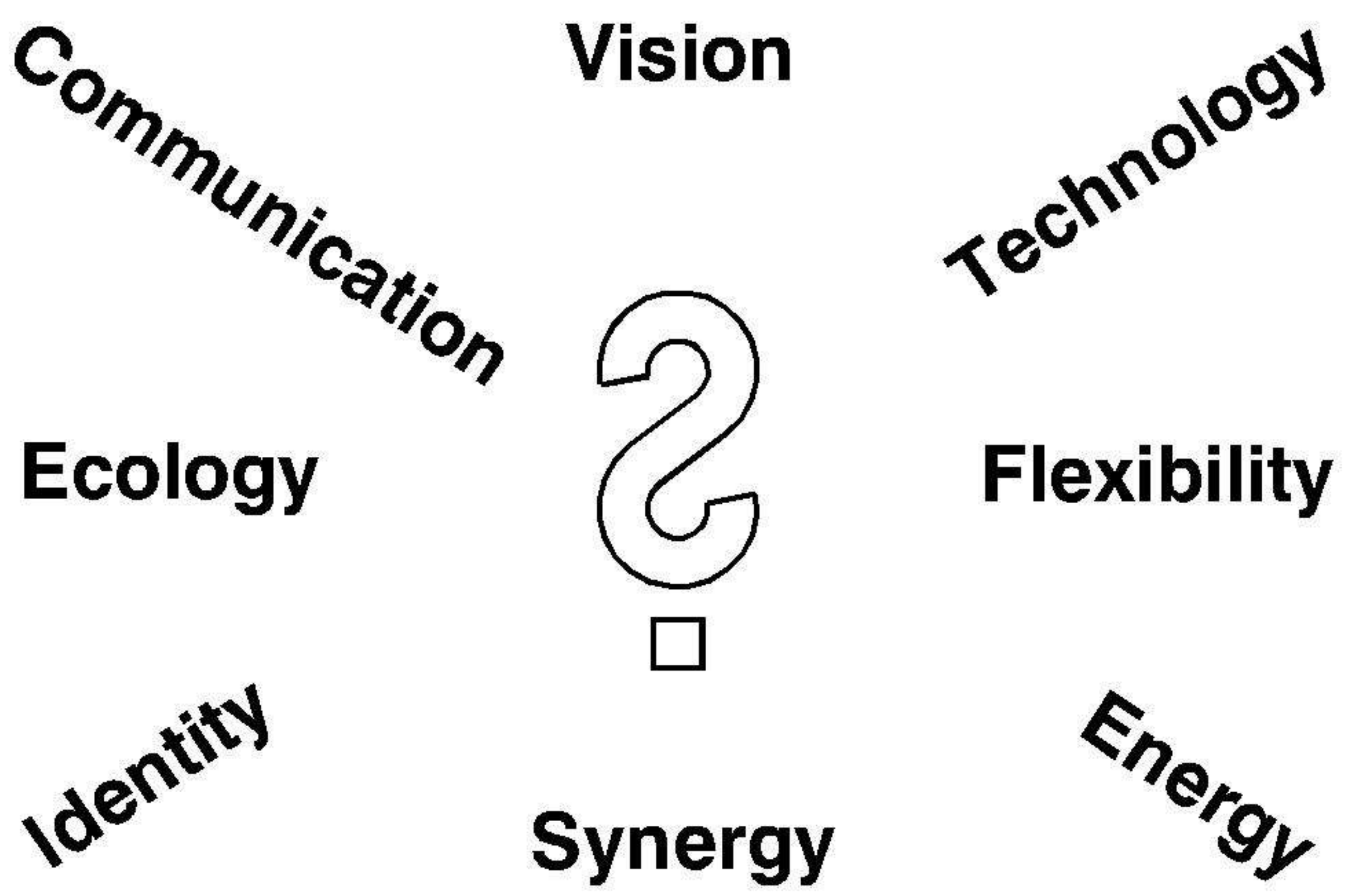
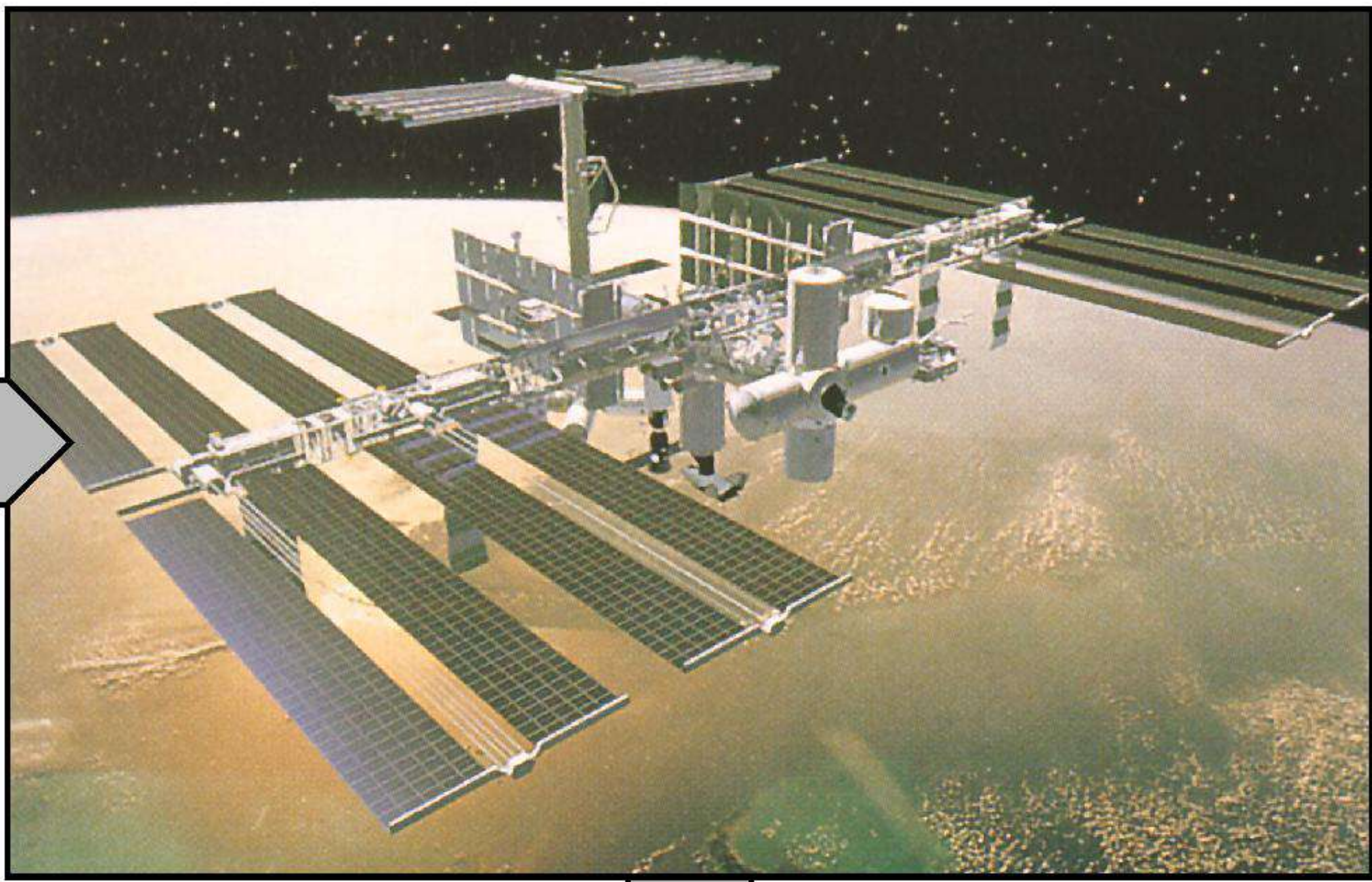
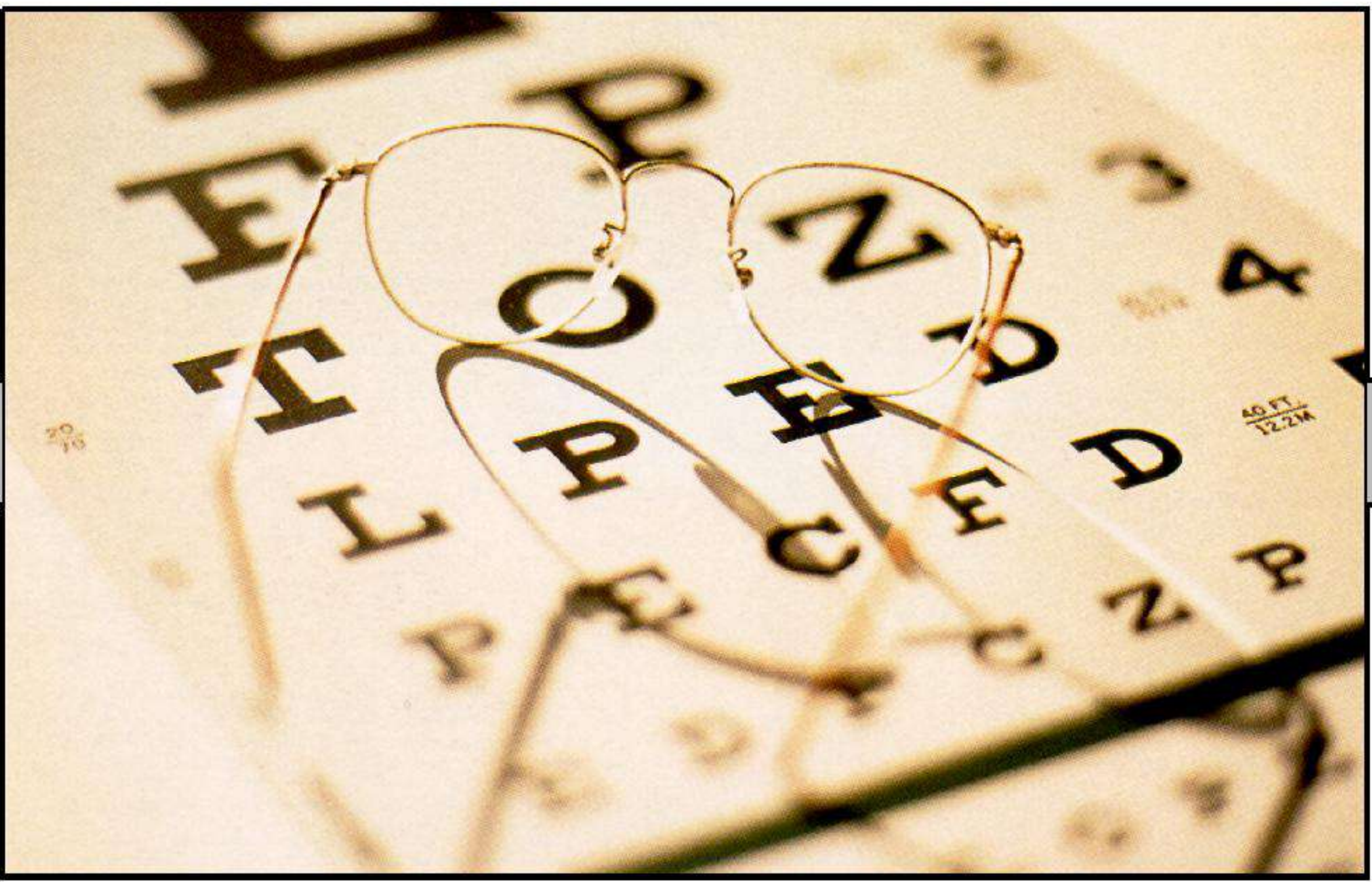
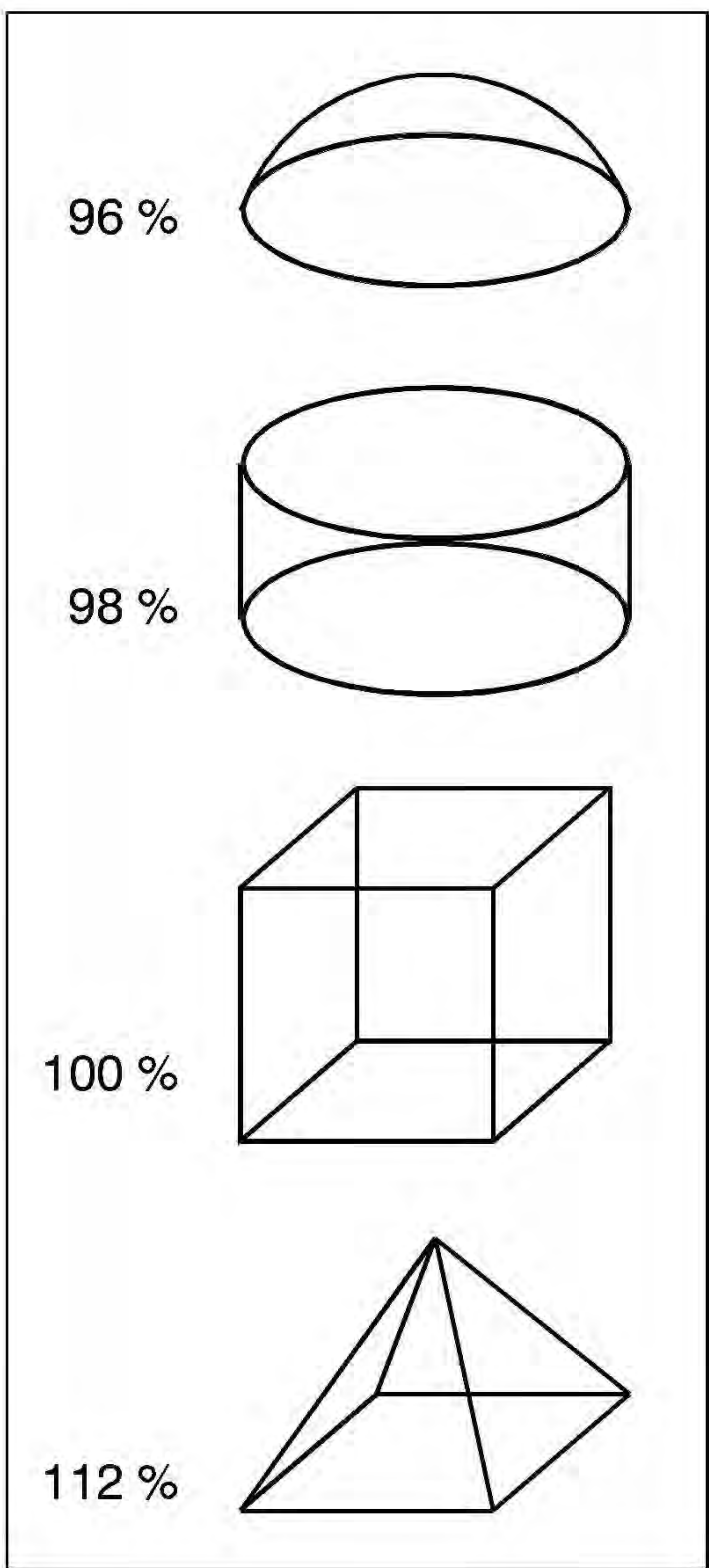


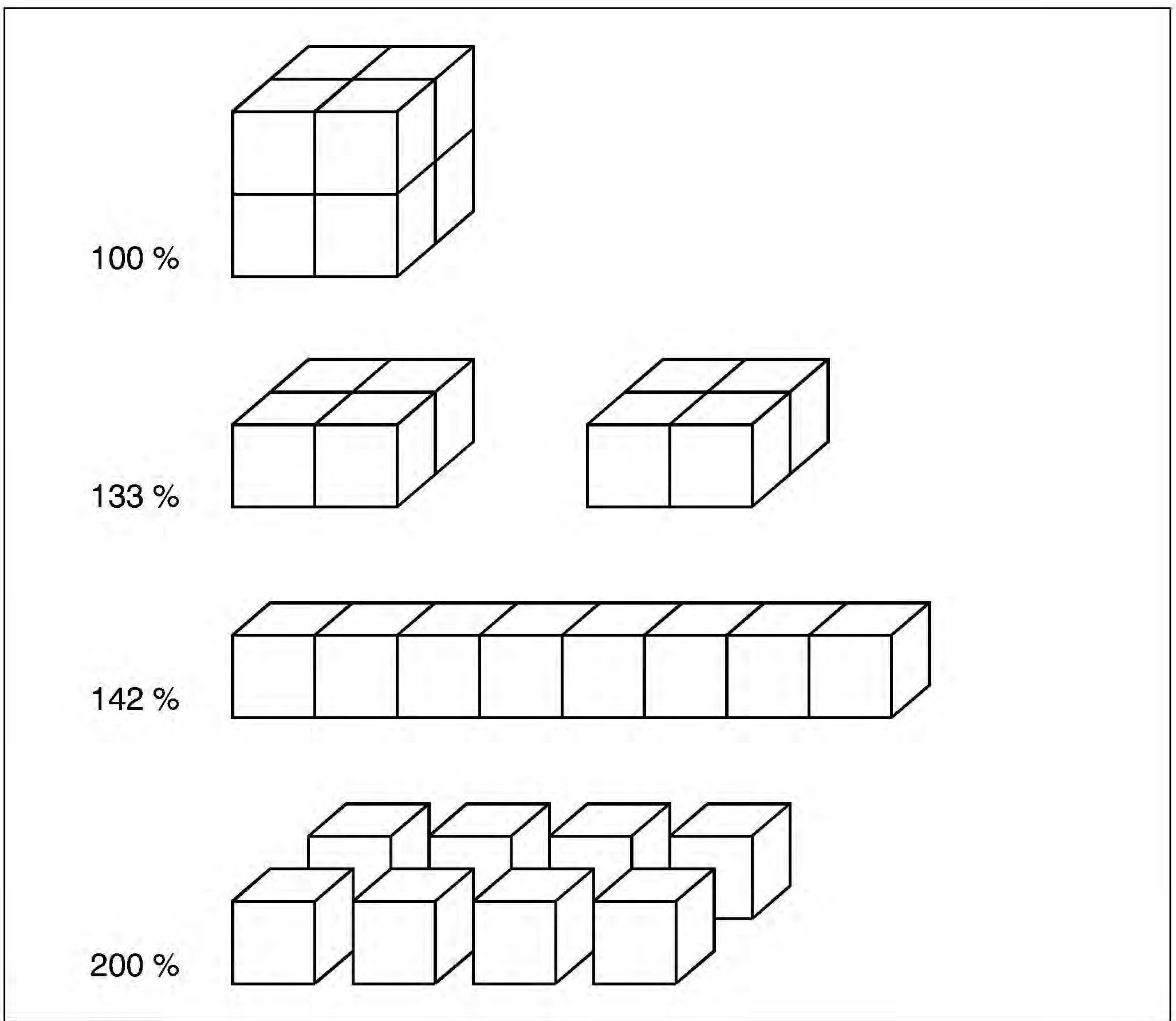
Buildings in Flux: Requirements



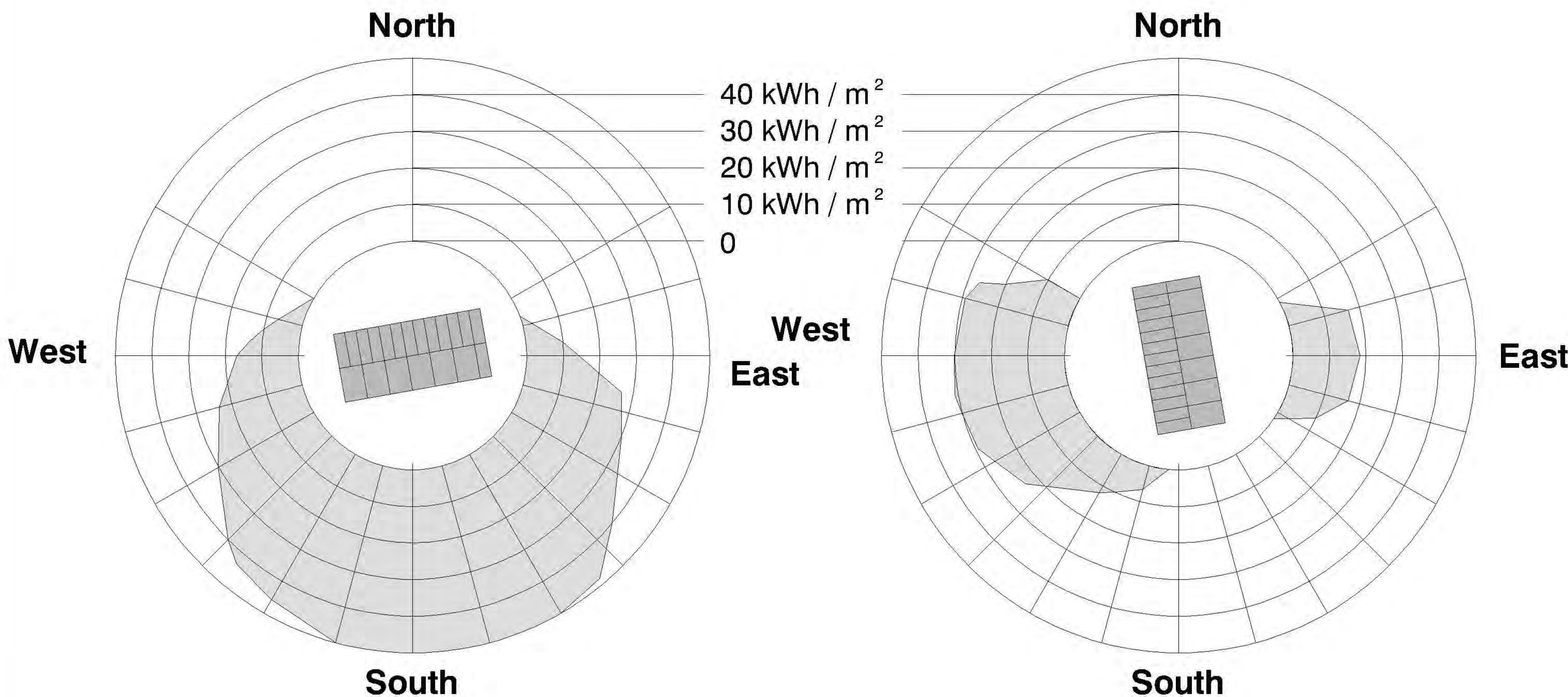
FM - figure 1.01



a) shape

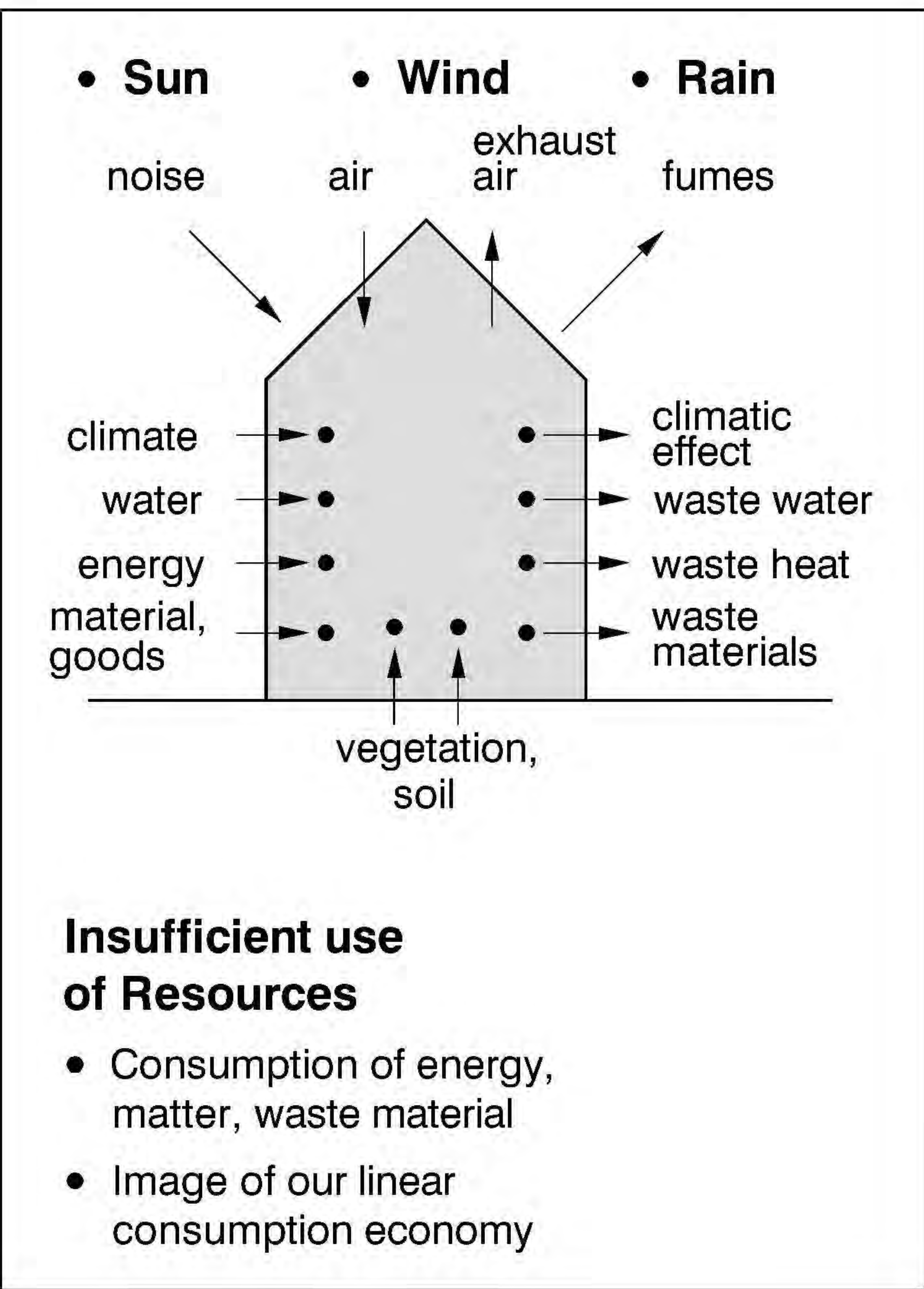


b) structure

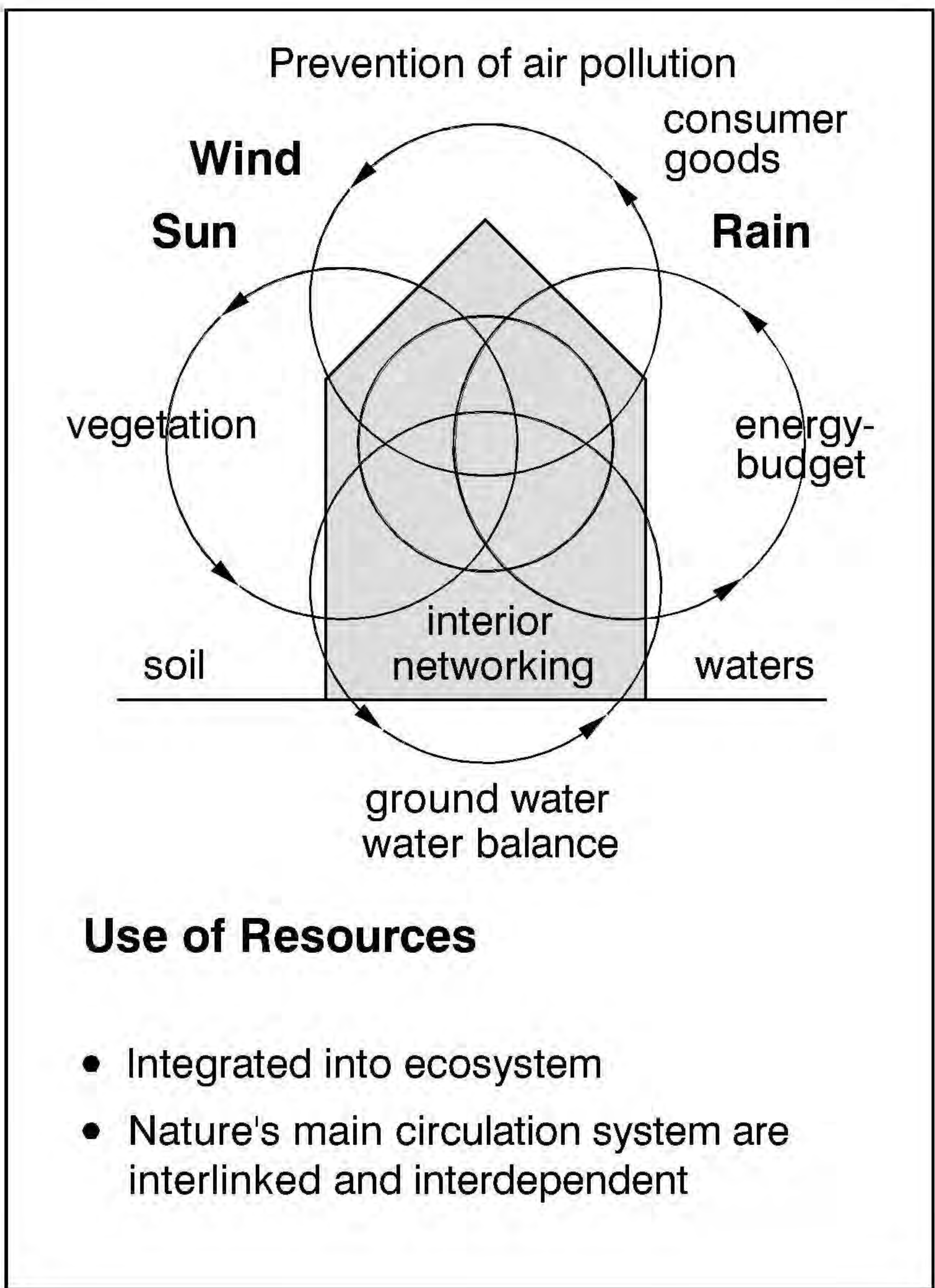


a) Solar radiation at twelve o'clock
Window orientation 170° (SSE)
Solar radiation gained in a day 255,9 kWh/sqm
window surface

b) Solar radiation at twelve o'clock
Window orientation 170° (WSW)
Solar radiation gained in a day 88,9 kWh/sqm
window surface



a) Conventional Building

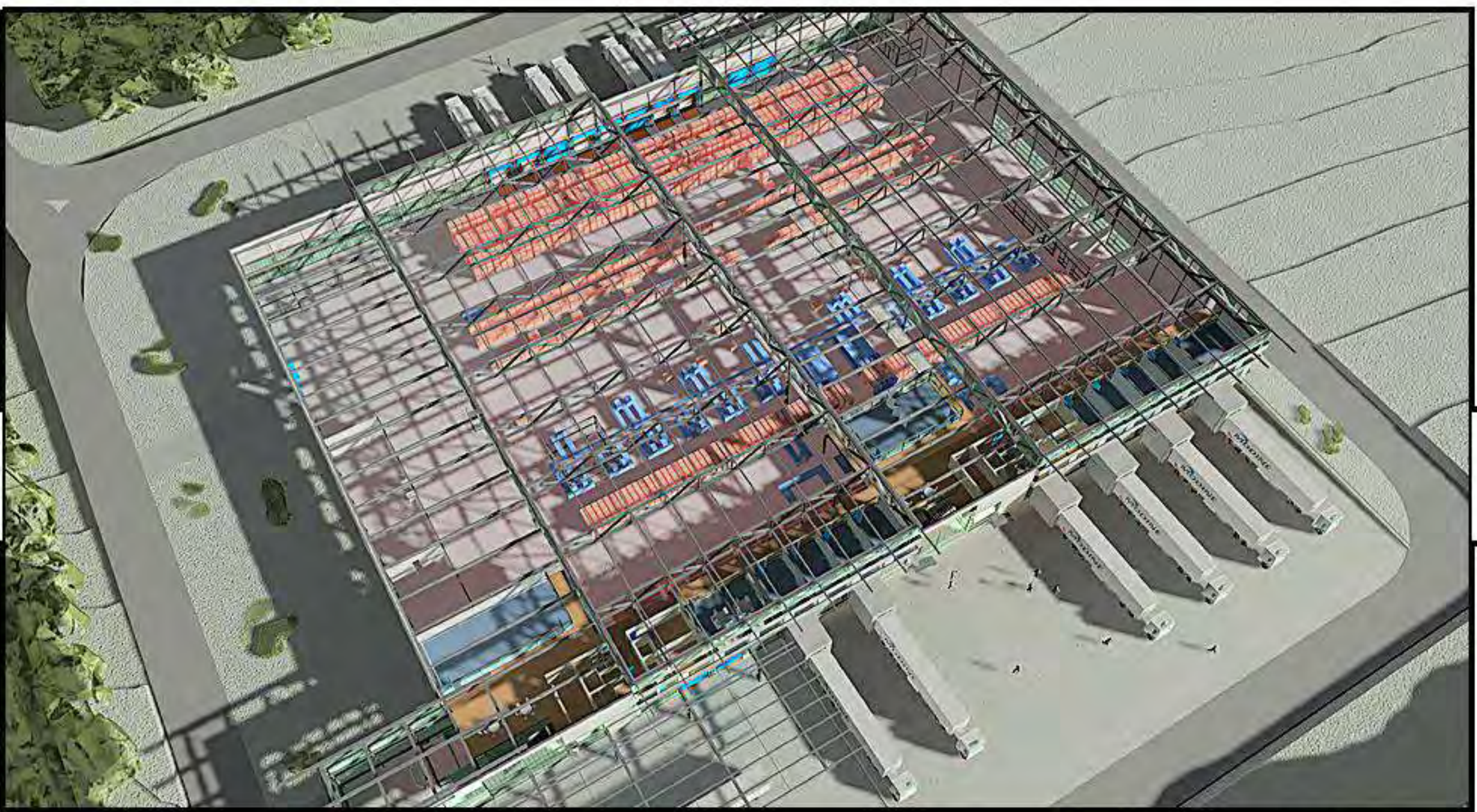


b) Adaptive Building

Performance Model: Examples for Industrial Buildings



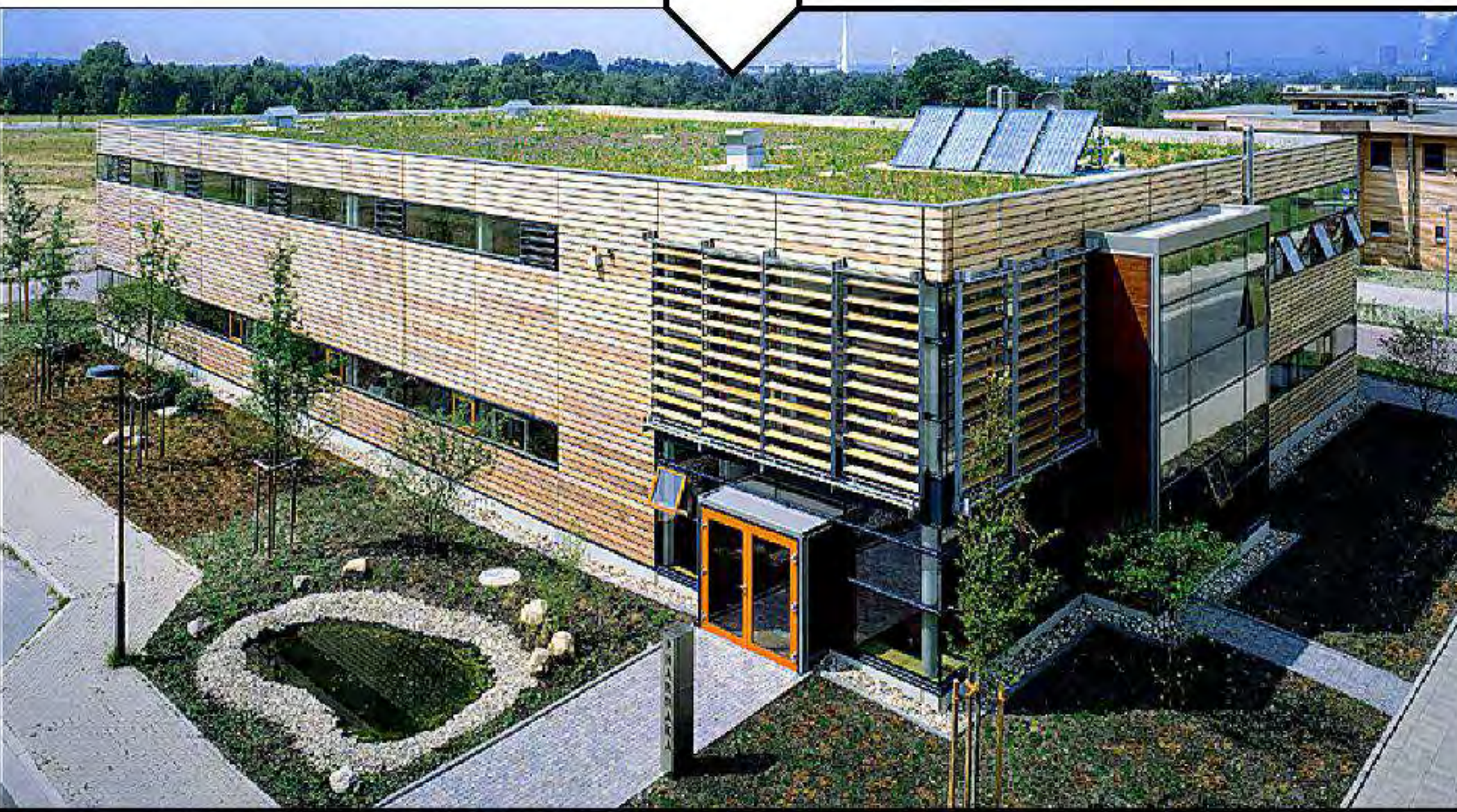
communication - promoting



vision - thinking



technology - using



ecology - networking

performance model:
- form follows performance



flexibility - securing



identity - creating



synergy - seeking



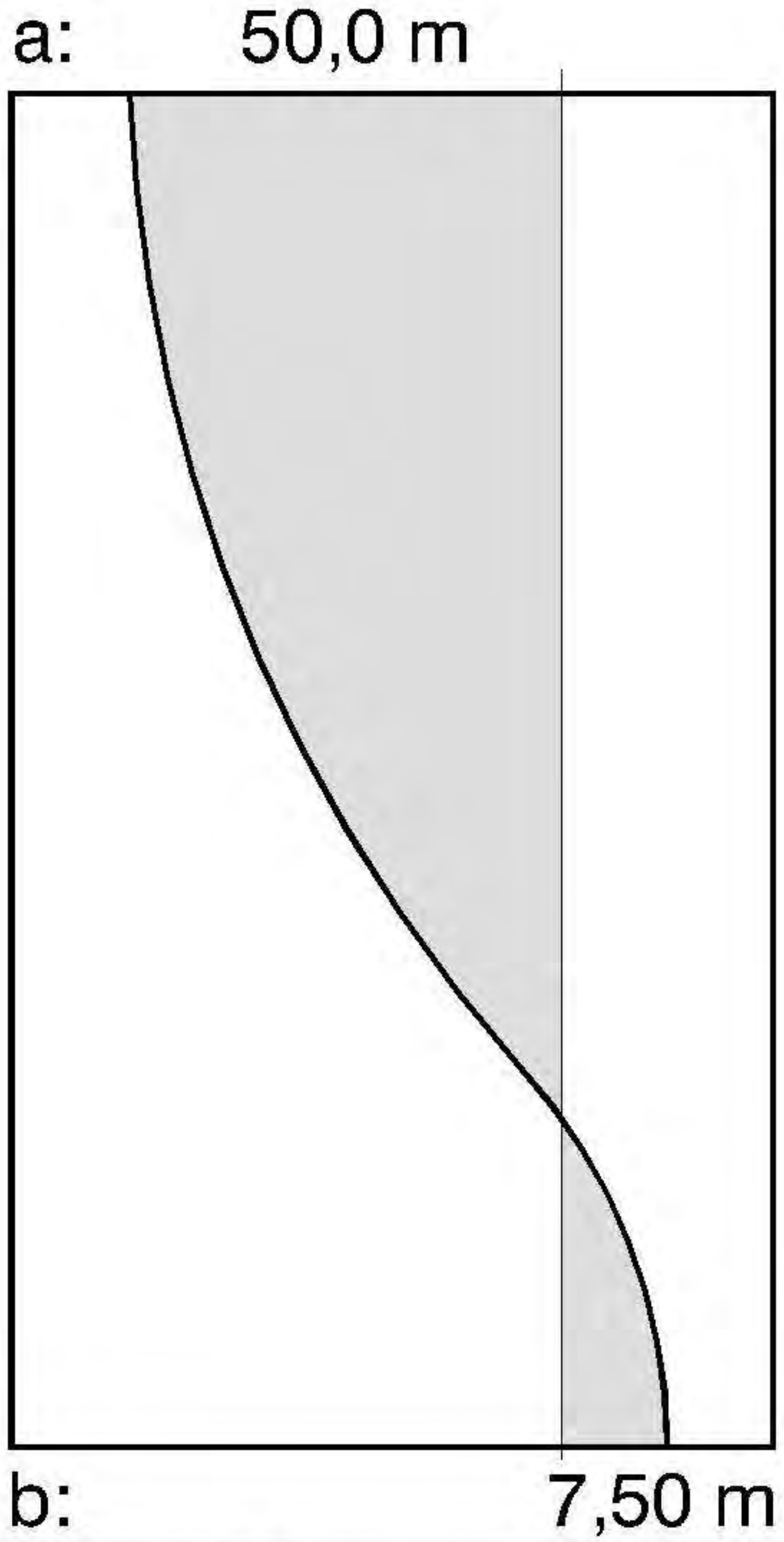
energy - optimising

Performance Model: Built Genetic Code



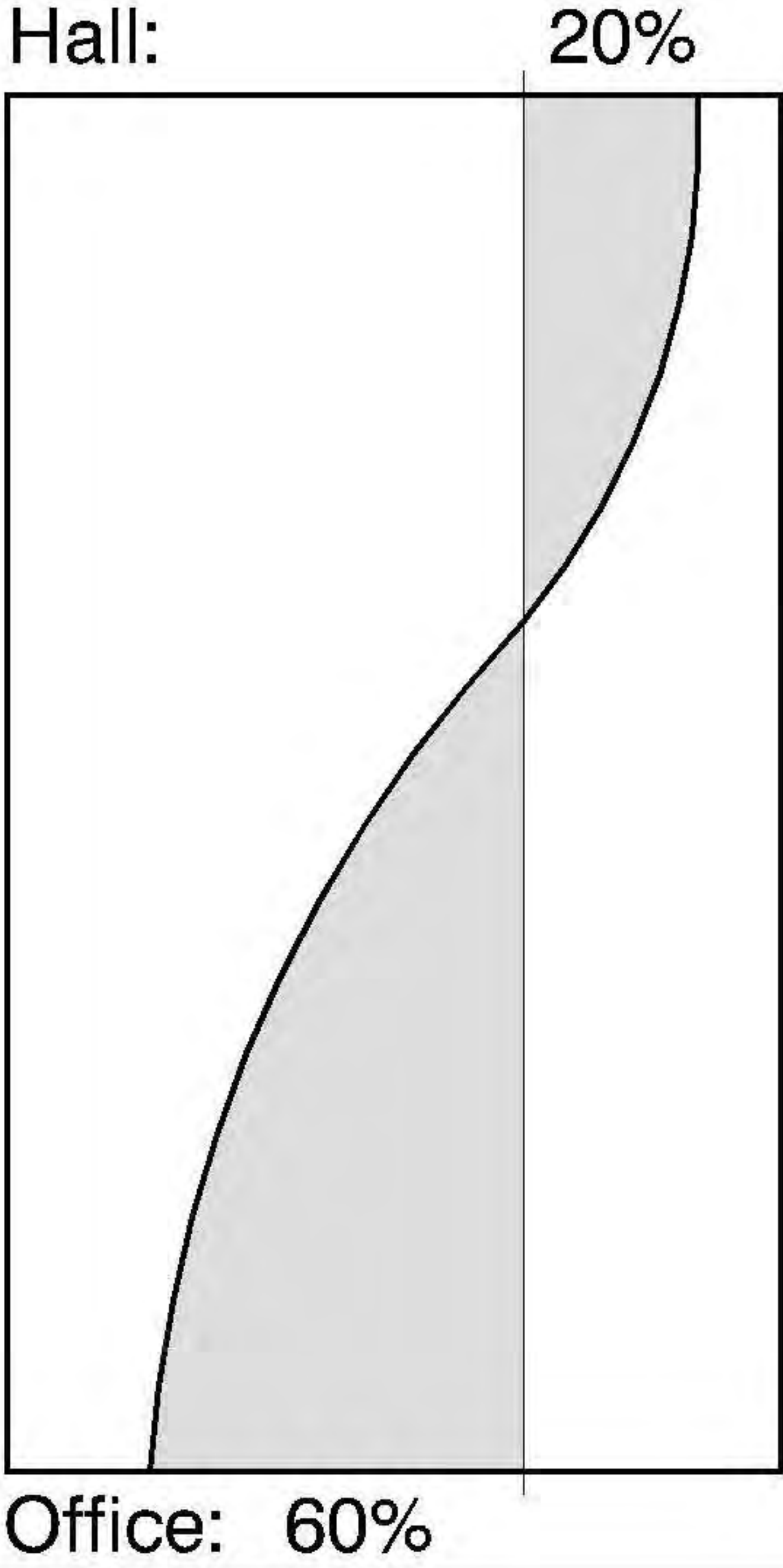
Parameter value
 Load bearing structure
 Example - Seat factory

Performance characteristic
 Span width



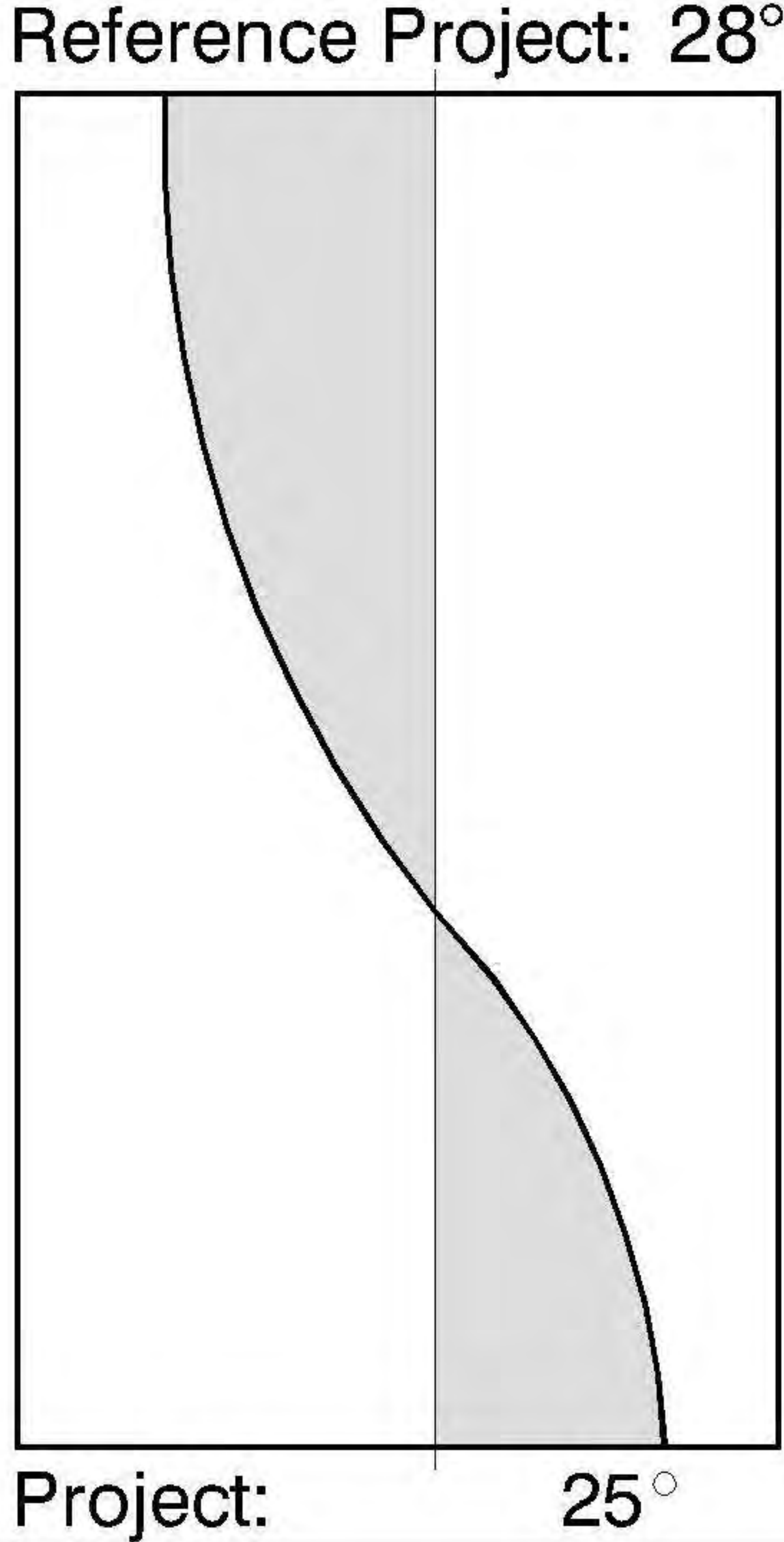
Parameter value
 Outer shell
 Example - Pharmaceutical production

Performance characteristic
 Openings



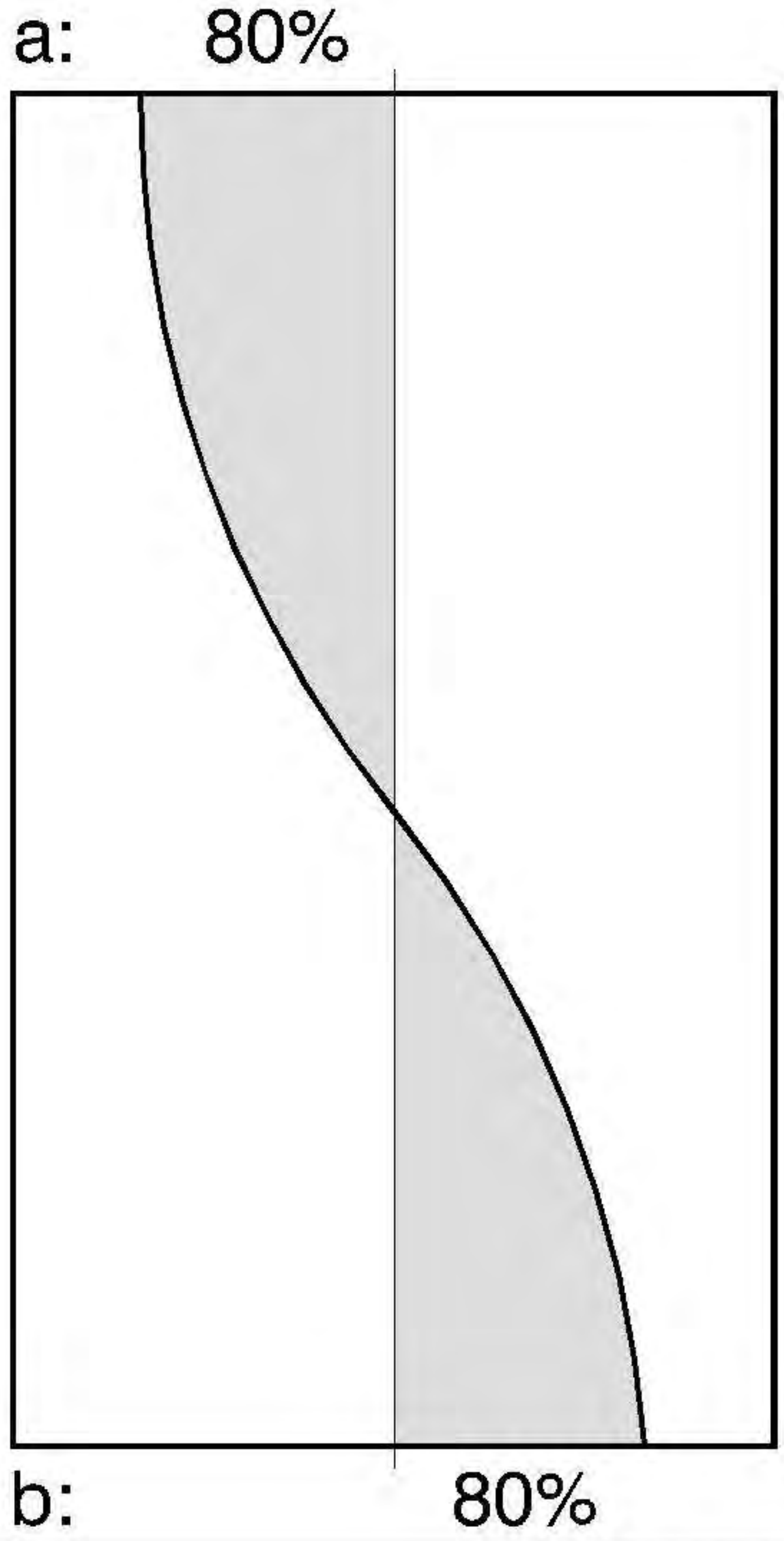
Parameter value
 Media
 Example - Industrial bakery

Performance characteristic
 Lowering air temperature at workstation



Parameter value
 Finishings
 Example - Assembly plant for engines

Performance characteristic
 Transparency



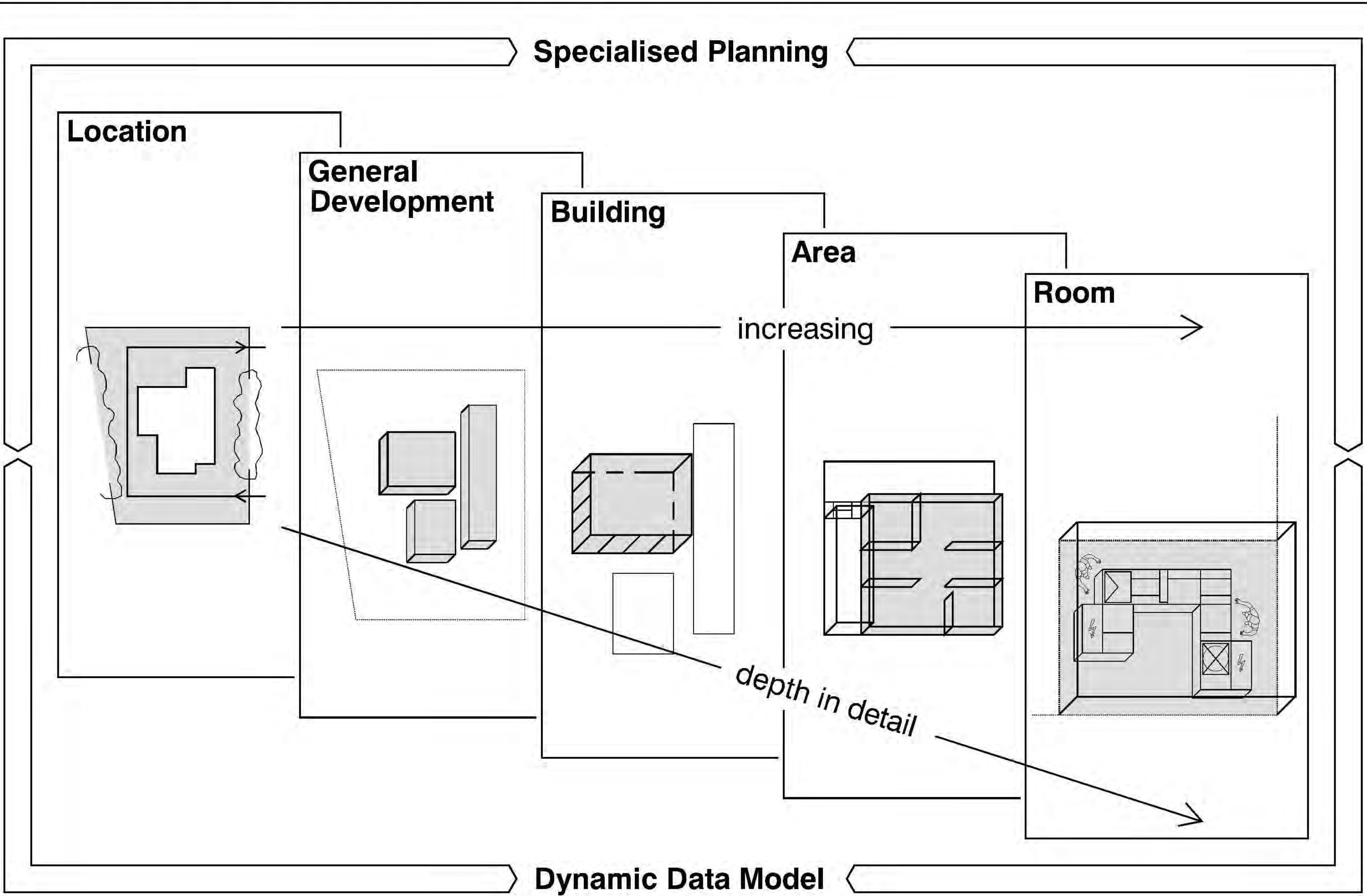
Location: Example for Structure Characteristics

Infrastructure	Supply, Disp. Media	Site	Environment	Laws and Conditions	Location Valuation
<ul style="list-style-type: none"> • road • rail • air • sea 	<ul style="list-style-type: none"> • electricity • water • gas • hot water, heating steam • drainage • waste water • data networks 	<ul style="list-style-type: none"> • geometric shape / land register • soil conditions • obstacles existing buildings 	<ul style="list-style-type: none"> • weather data • ventilation • plantation 	<ul style="list-style-type: none"> • zoning plans • legally binding land-use plans • design ordinances • state laws • special regulations • master plan 	<ul style="list-style-type: none"> • preparation of land for building • supply, disposal • site • labour market • environment • expandability • planning and building laws • purchasing price • promotions

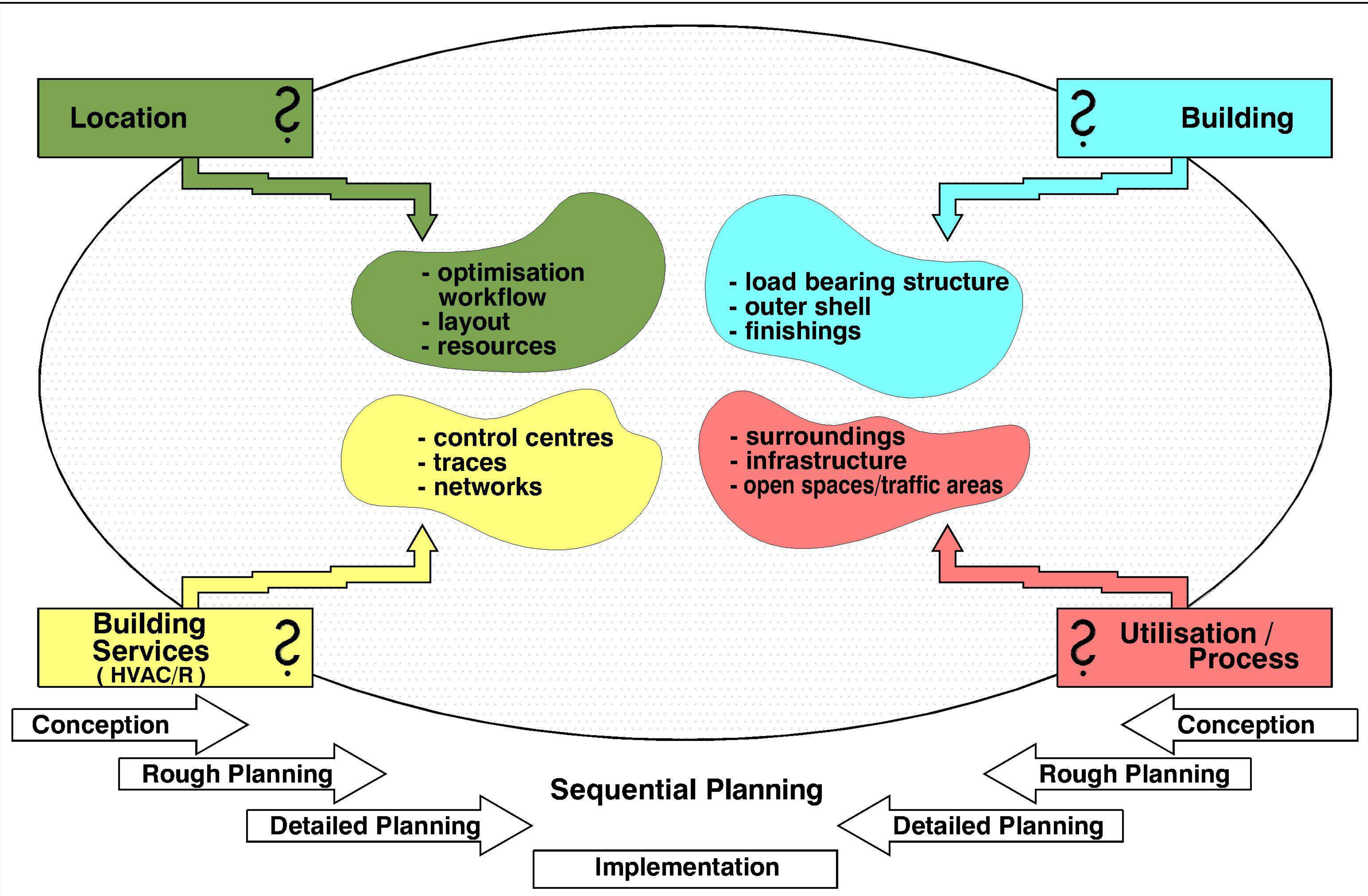
Building: Example for Structure Characteristics

Load Bearing Structure	Outer Shell	Media	Finishings	Appearance
<ul style="list-style-type: none">• project requirements load assumptions• structural shape / static system• choice of material• principles of joining• profile columns, girders, ceilings	<ul style="list-style-type: none">• protective functions• lighting / view• process / logistics• ecology / building climatisation• energy generation• communication	<ul style="list-style-type: none">• supply system process• supply system building• control centres• main traces• networks• connections	<ul style="list-style-type: none">• floors• walls• ceilings• cores• staircases	<ul style="list-style-type: none">• structural order• simplicity• balance of simplicity and multitude• distinctiveness• emotional quality

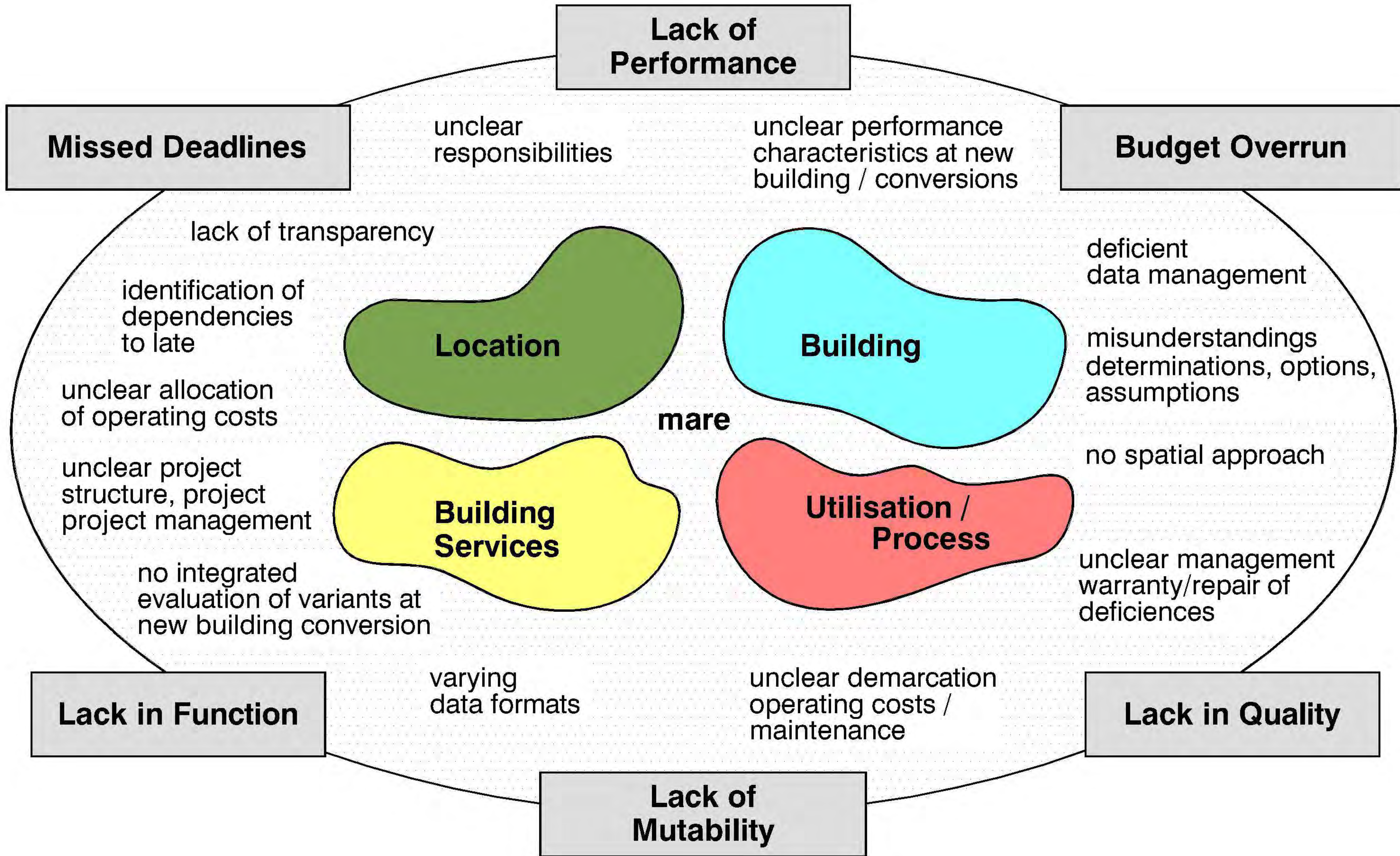
Data Model: Design Levels / Design Elements



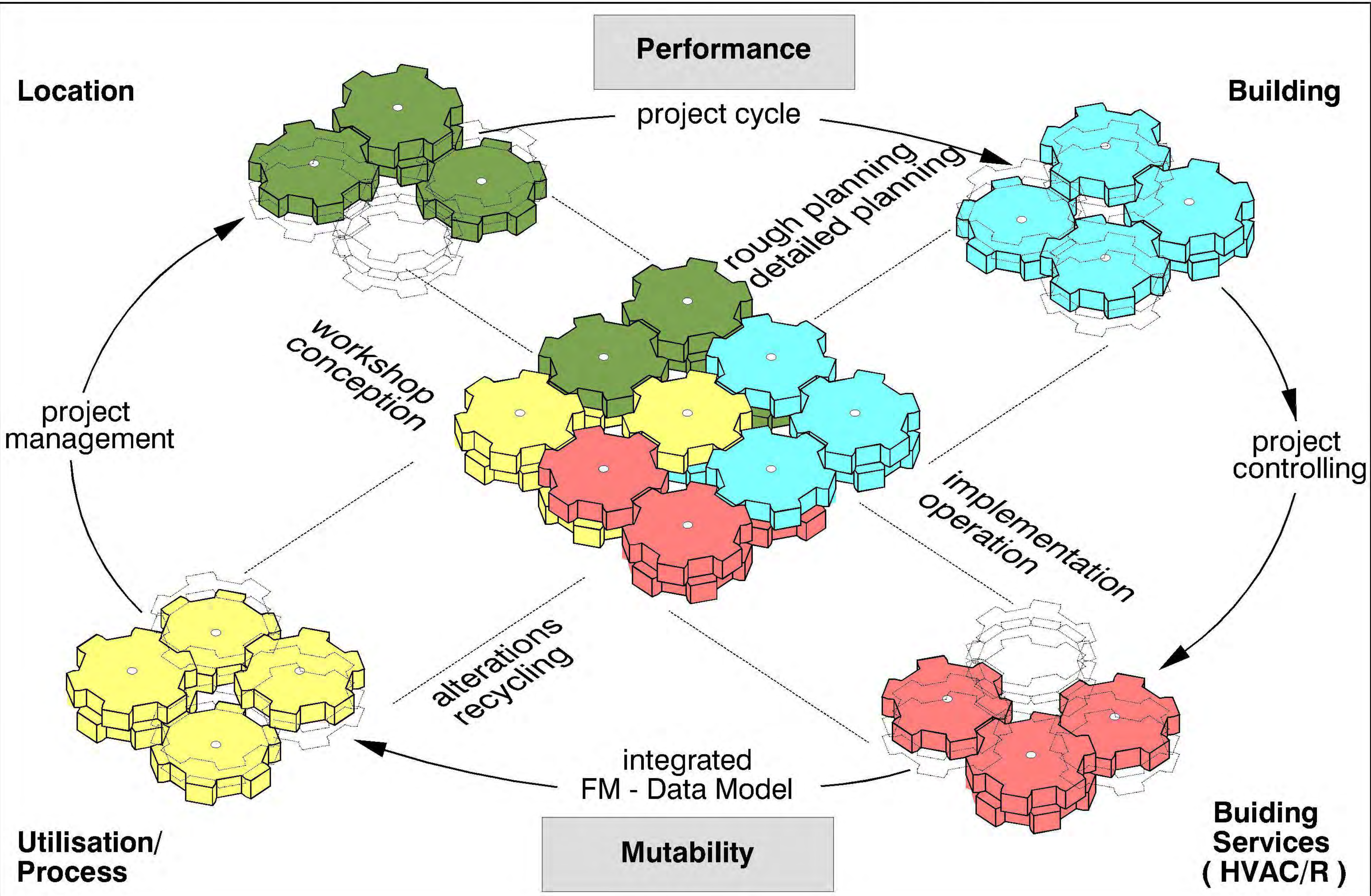
Planning / Operation: Isolated Sectoral Planning by means of many Separated Sub-projects



Planning/Operation: Frequent Shortcomings caused by Interfaces of Sub-Projects

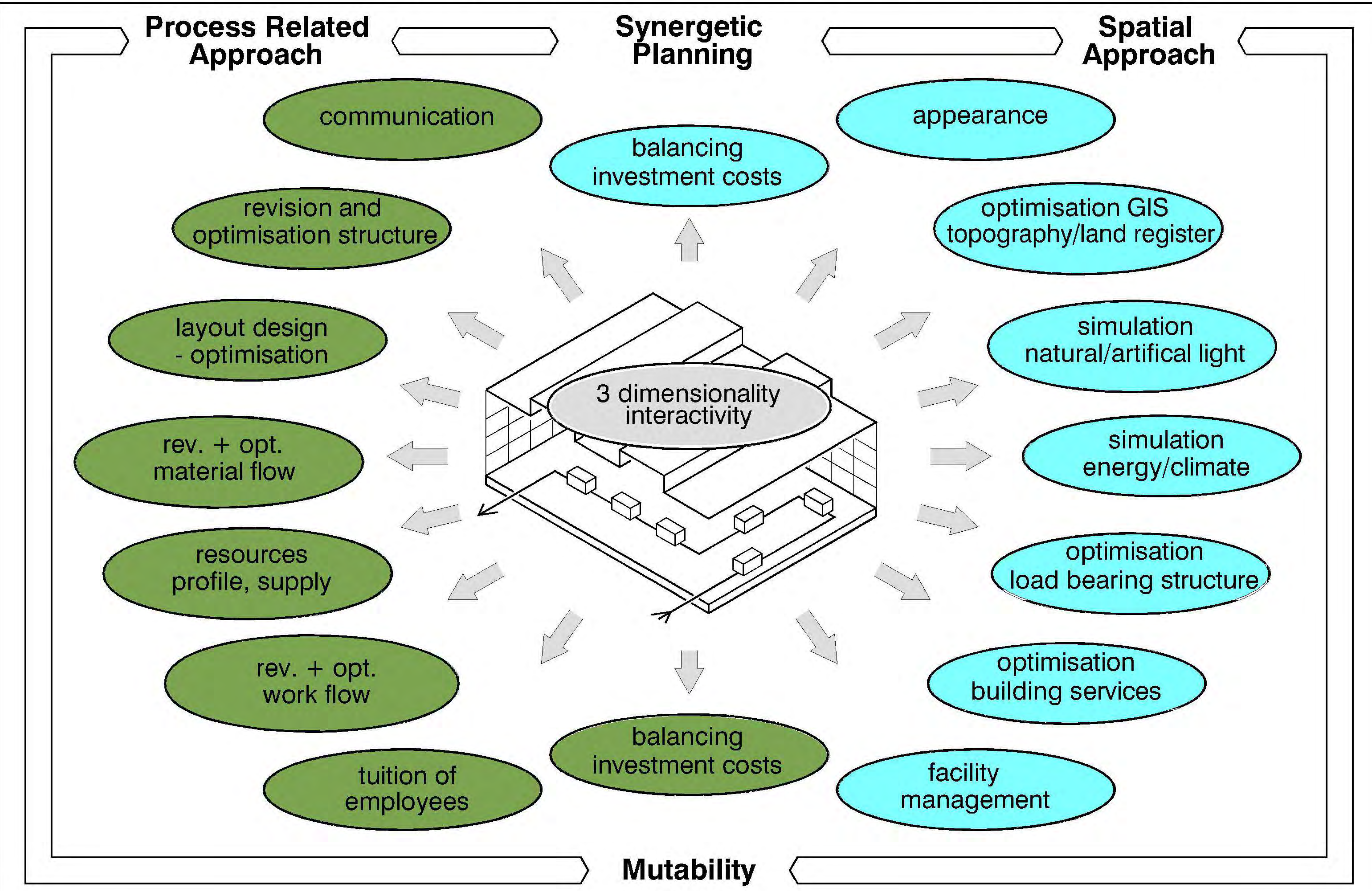


Synergetic Planning / Operation: Integration of Sub-Projects

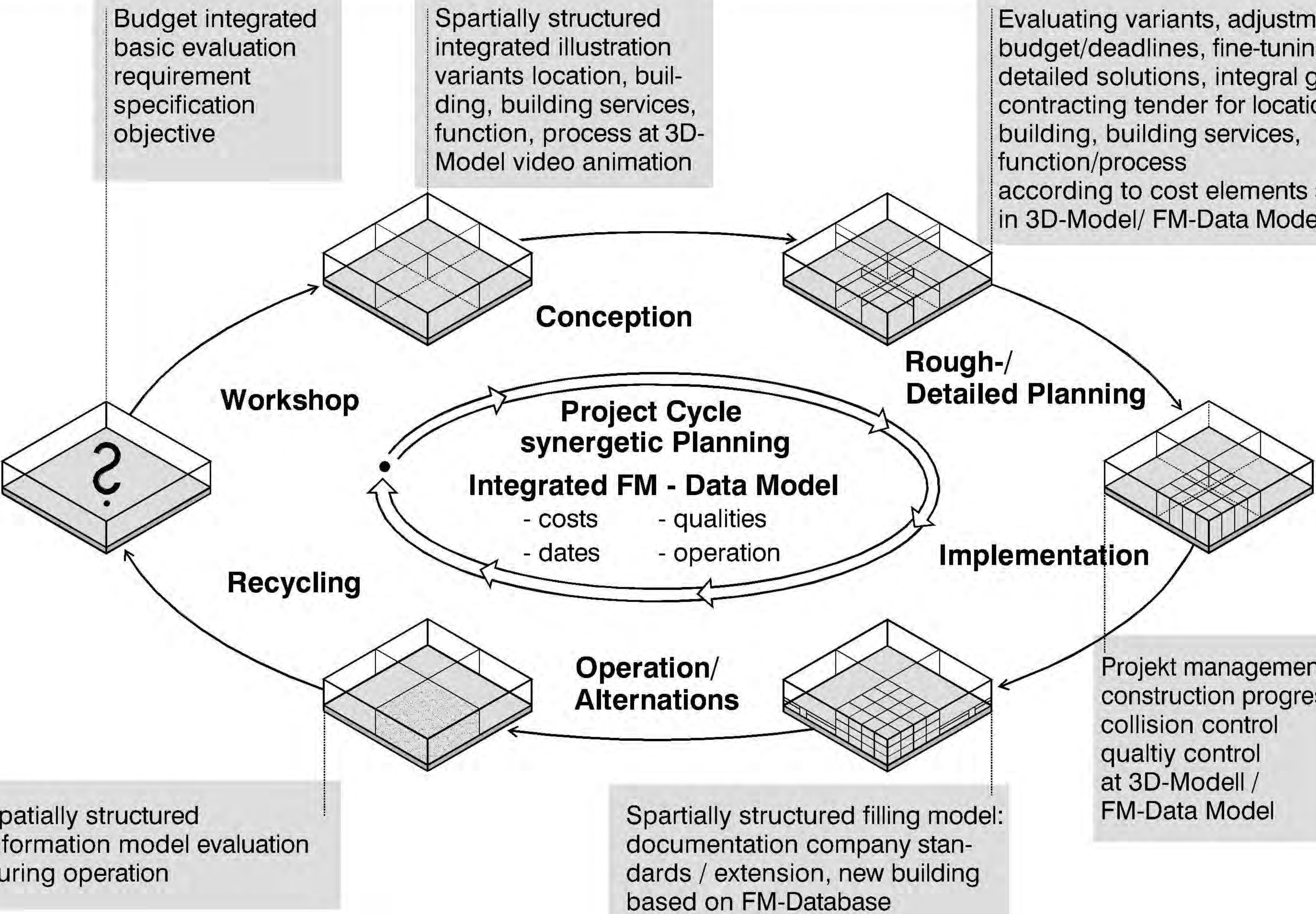


FM - figure 1.12

Evaluations provided by Synergetic Data Model: Example - Factory Design



Synergetic Quality Cycle by means of 3D-Data Model



Budget integrated
basic evaluation
requirement
specification
objective

Spatially structured
integrated illustration
variants location, buil-
ding, building services,
function, process at 3D-
Model video animation

Evaluating variants, adjustment
budget/deadlines, fine-tuning
detailed solutions, integral general
contracting tender for location,
building, building services,
function/process
according to cost elements stated
in 3D-Model/ FM-Data Model

Spatially structured
information model evaluation
during operation

Spatially structured filling model:
documentation company stan-
dards / extension, new building
based on FM-Database

Projekt management
construction progress
collision control
quality control
at 3D-Modell /
FM-Data Model

Tasks of Facility Management regarding Real Estate

Acquisition and Provision of up-to-date Data

- premises
- buildings
- building services systems
- equipment
- degree of utilisation
- market value

Evaluation of Locations, Buildings and Equipment

- work surroundings
- concepts for organisation
- consequential costs
- appearance
- security, safety

Space and Utilisation Planning

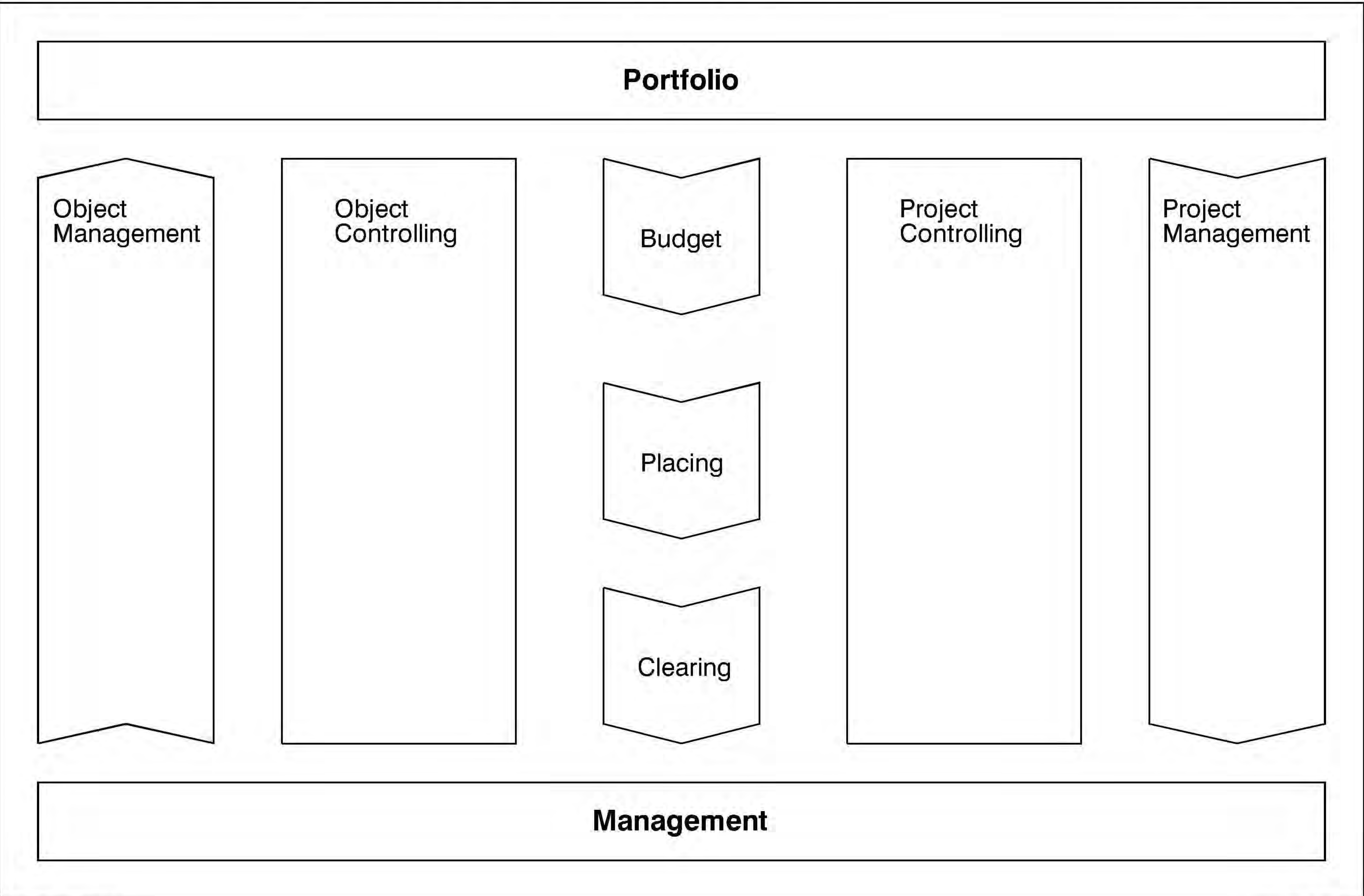
- workstations
- physical
- legal
- ergonomic
- organisational
- sociological

Operations and Maintenance Management

- utilisation costs
- service costs
- maintenance concept
- lifecycle data
- operations

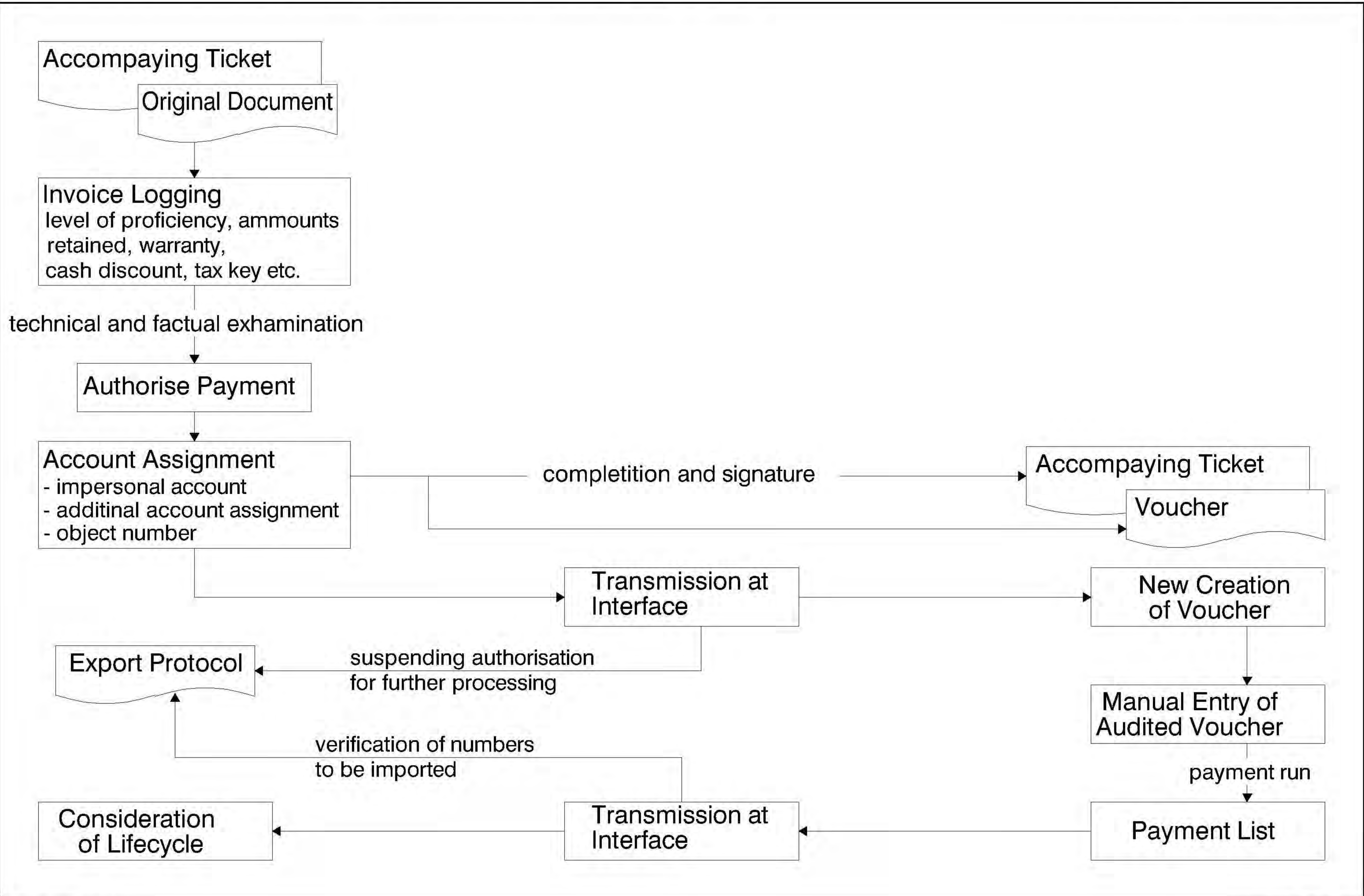
Budgeting and Valuation

- valuation of measures
- developing alternatives
- consideration of lifecycle
- consideration of ecologic consequences



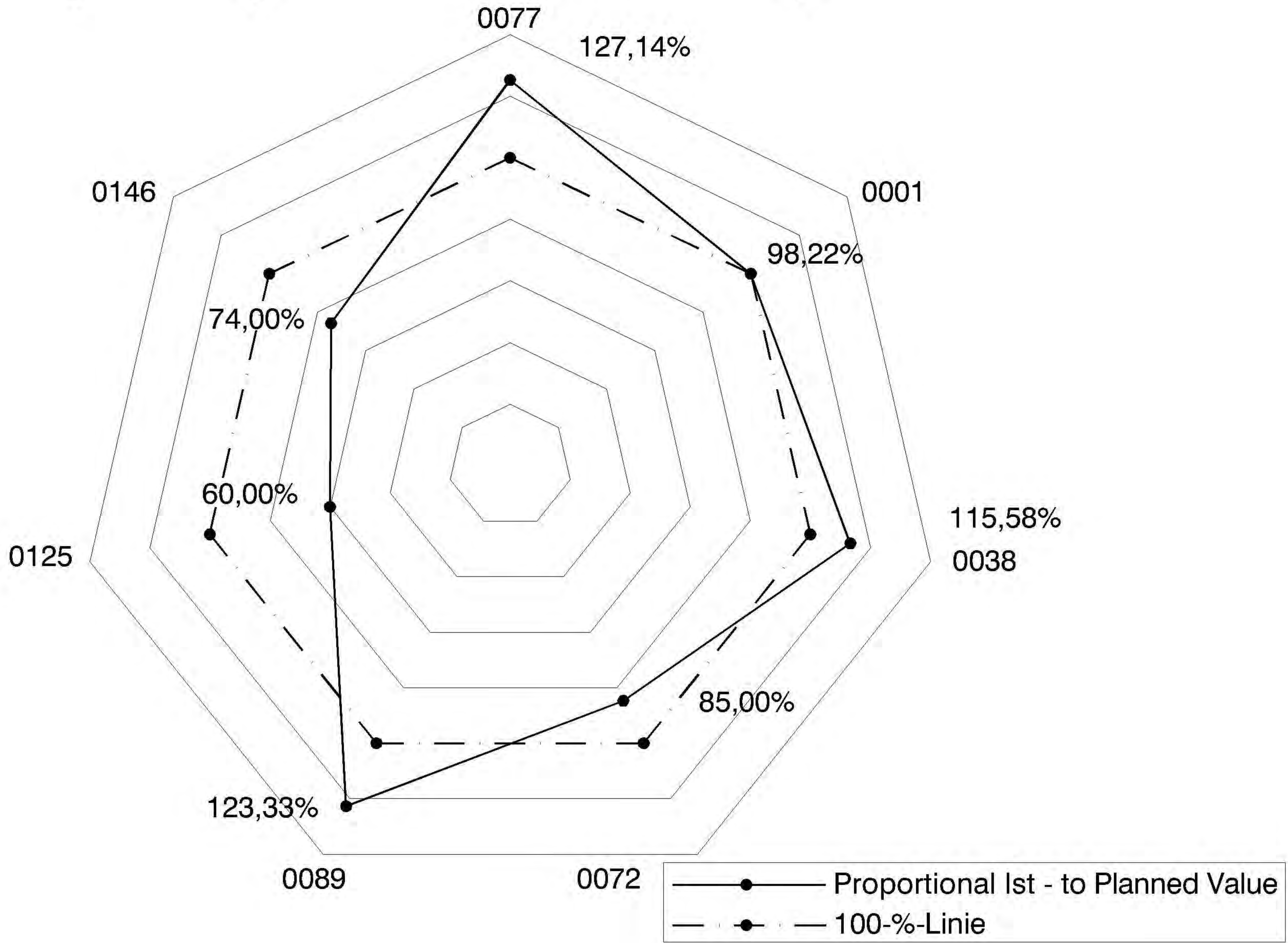
Process Flow of Integrated Invoice Logging

[according to Wildgruber]

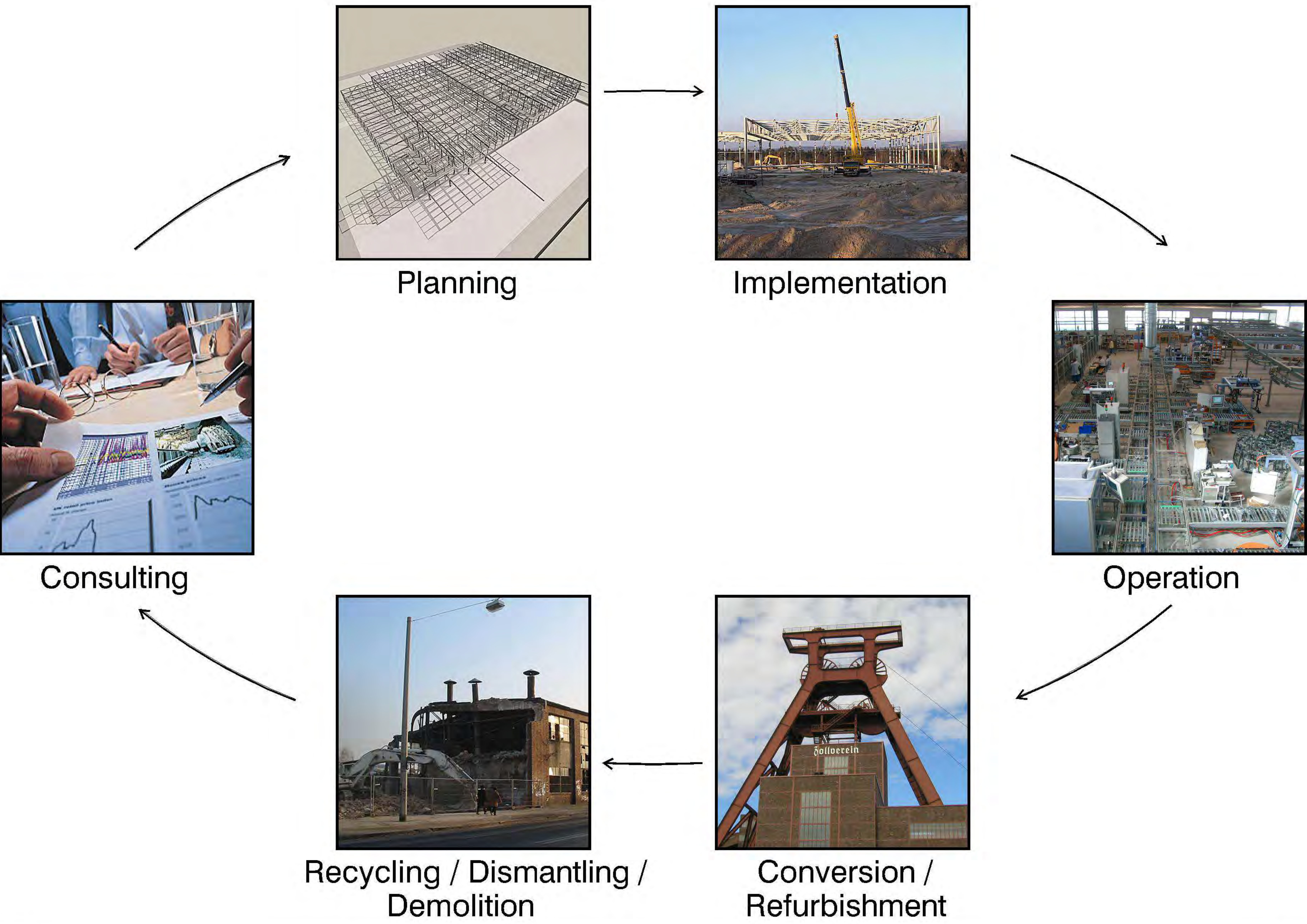


FM - figure 2.03

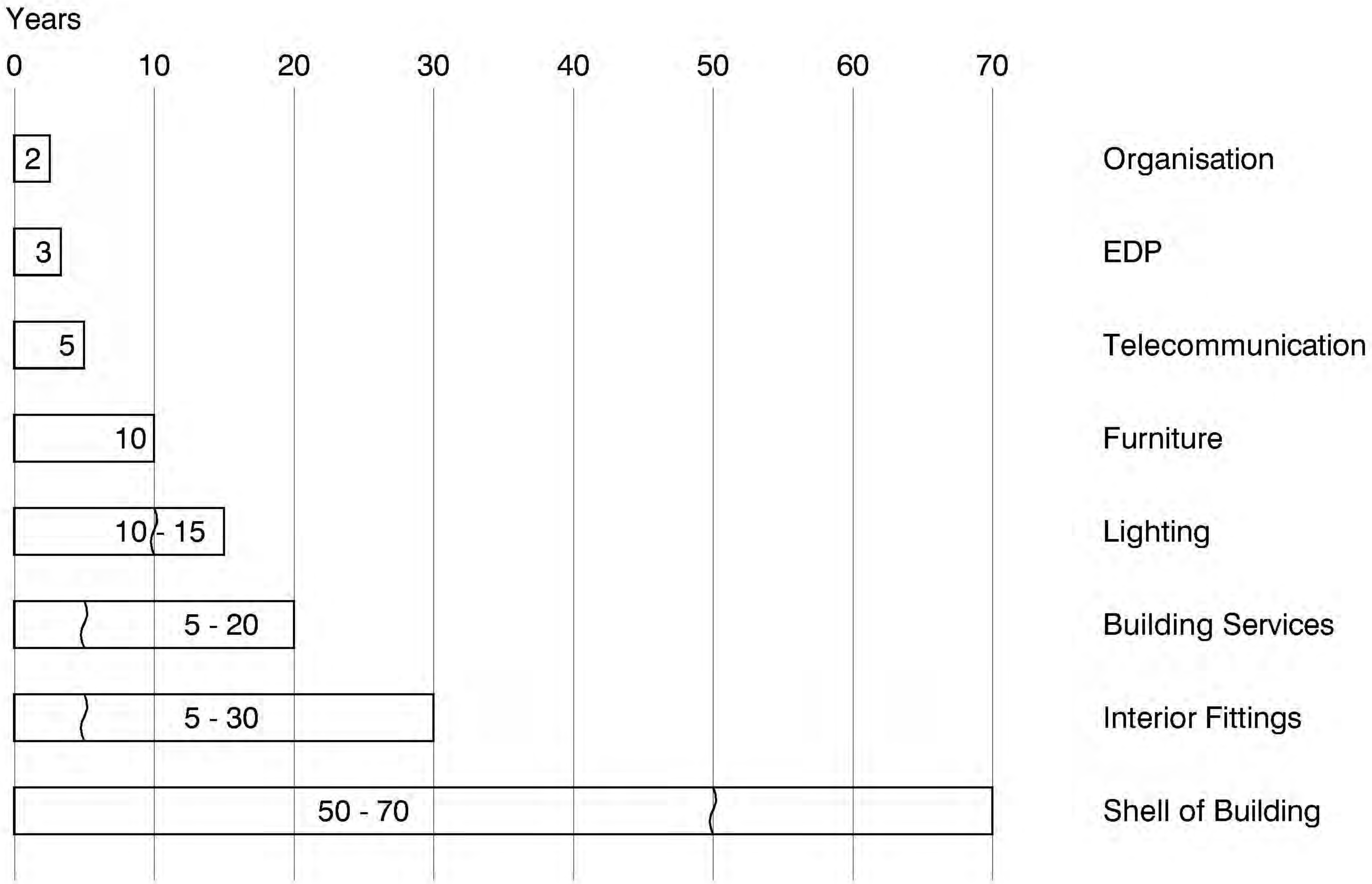
Example for Analysis of Adherence to Planned Budget



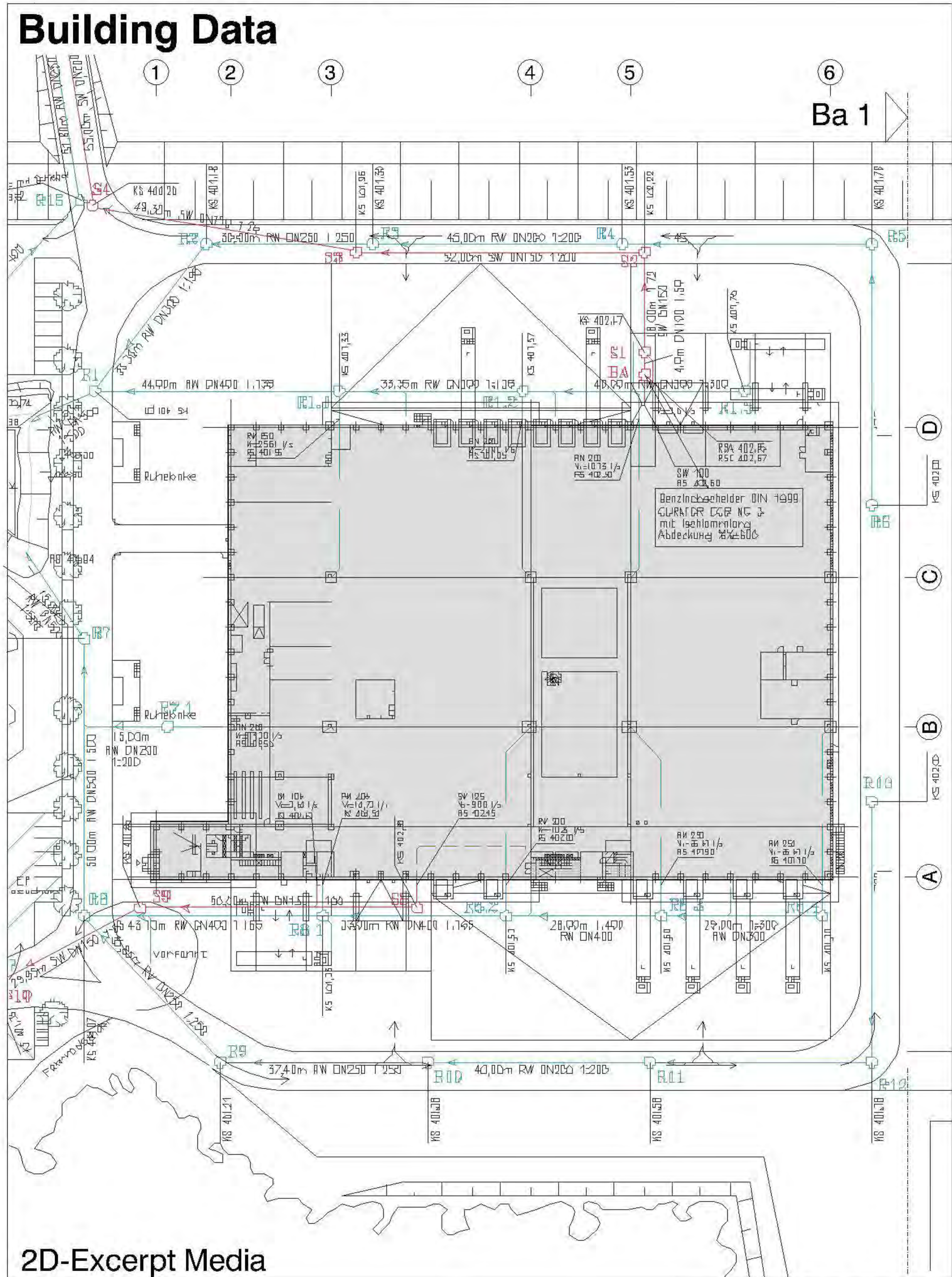
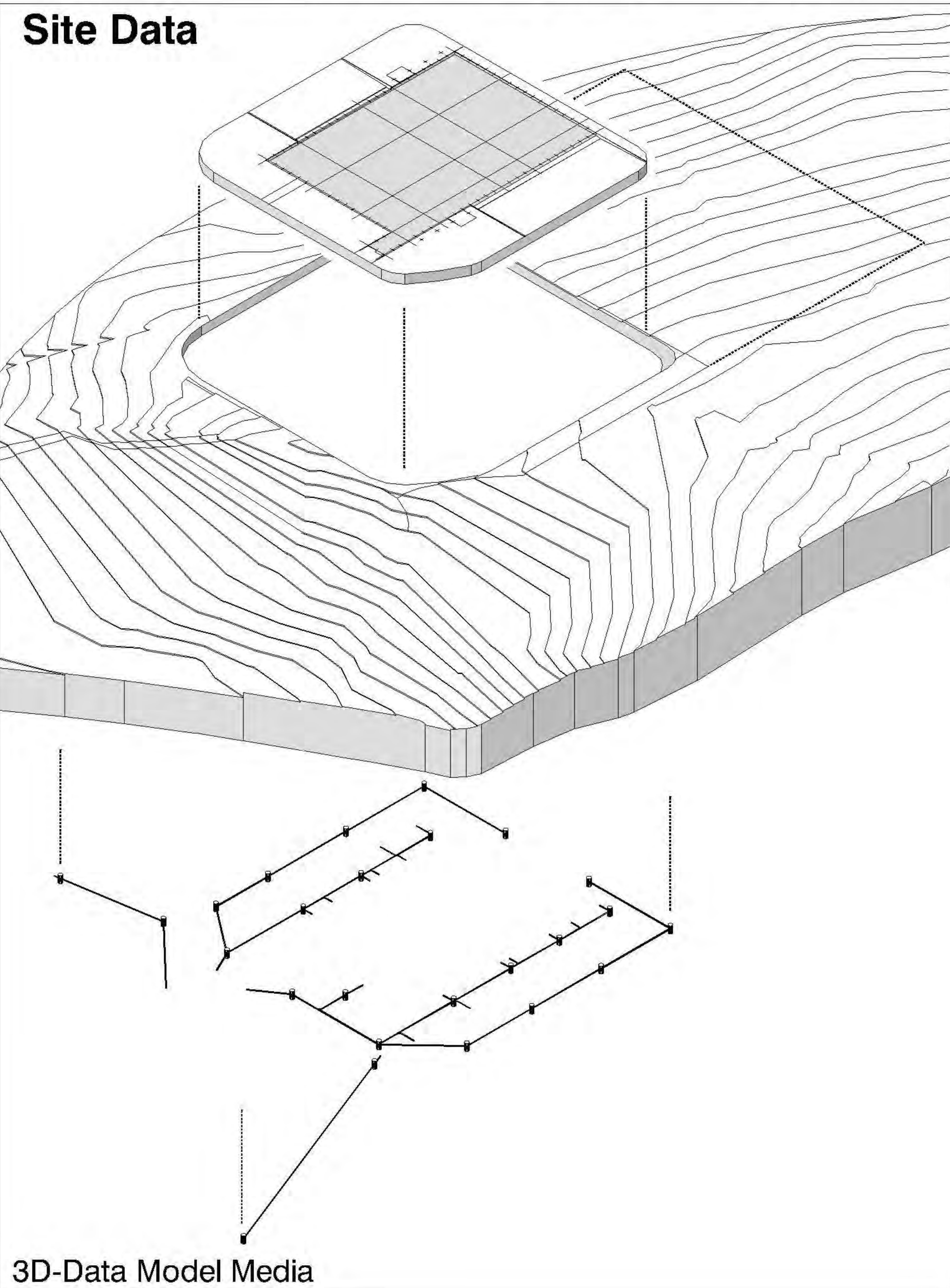
Stages in the Lifecycle of Real Estate



Alteration Intervals regarding Existing Property, Examples



3D-Data Model of Supply and Disposal at an Assembly Plant



Example for an Input Mask - Communal Real Estate

Site Data

Grundstücksdaten

Ortsteil/Gemeinde:

Straße/Nr.:

Grundstücksgröße: m²

Eigentumsverhältnisse Normaleigentum Erbbaurecht gepachtet

Das Grundstück ist: bebaut betriebsnotwendig Vorratsfläche

Bodenwert **Wertgutachten**

Verkehrswert des Grundstückes: Euro

Verkehrswert der Außenanlagen: Euro

nach Gutachten vom:

Schätzwerte

Bodenrichtwert: Euro pro m²

Alternativ. Schätzung: im Jahr:

Katasterangaben

Gemarkung Flur Flurstück

Planungsrechtliche Ausweisung

Kosten und Beschränkungen

Datensatz: 2 von 2

Building Data

Gebäudedaten

Allgemeine Angaben zum Gebäude Straße/Nr.:

Gebäudebezeichnung

Bauwerksart:

Baujahr Denkmalschutz

Nutzung: eigengenutzt teilvermietet vermietet angemietet

Anteil der eigengenutzten Flächen

Flächen

Brutto-Grundfläch m²

Funktionsfläche m²

Netto-Grundfläche m²

Nutzfläche m²

Verkehrsfläche m²

Brutto-Rauminhalt m³

Wertangaben zum Gebäude

Anschaffungs-/Herstellungskosten:

Versicherungswert:

Verkehrswert des Gebäudes:

nach Gutachten vom:

Lebensdauer des Gebäudes

Übliche Gesamtnutzungsdauer: Jahre

Restnutzungsdauer (RND): Jahre, im Jahr:

Datensatz: 1 von 1

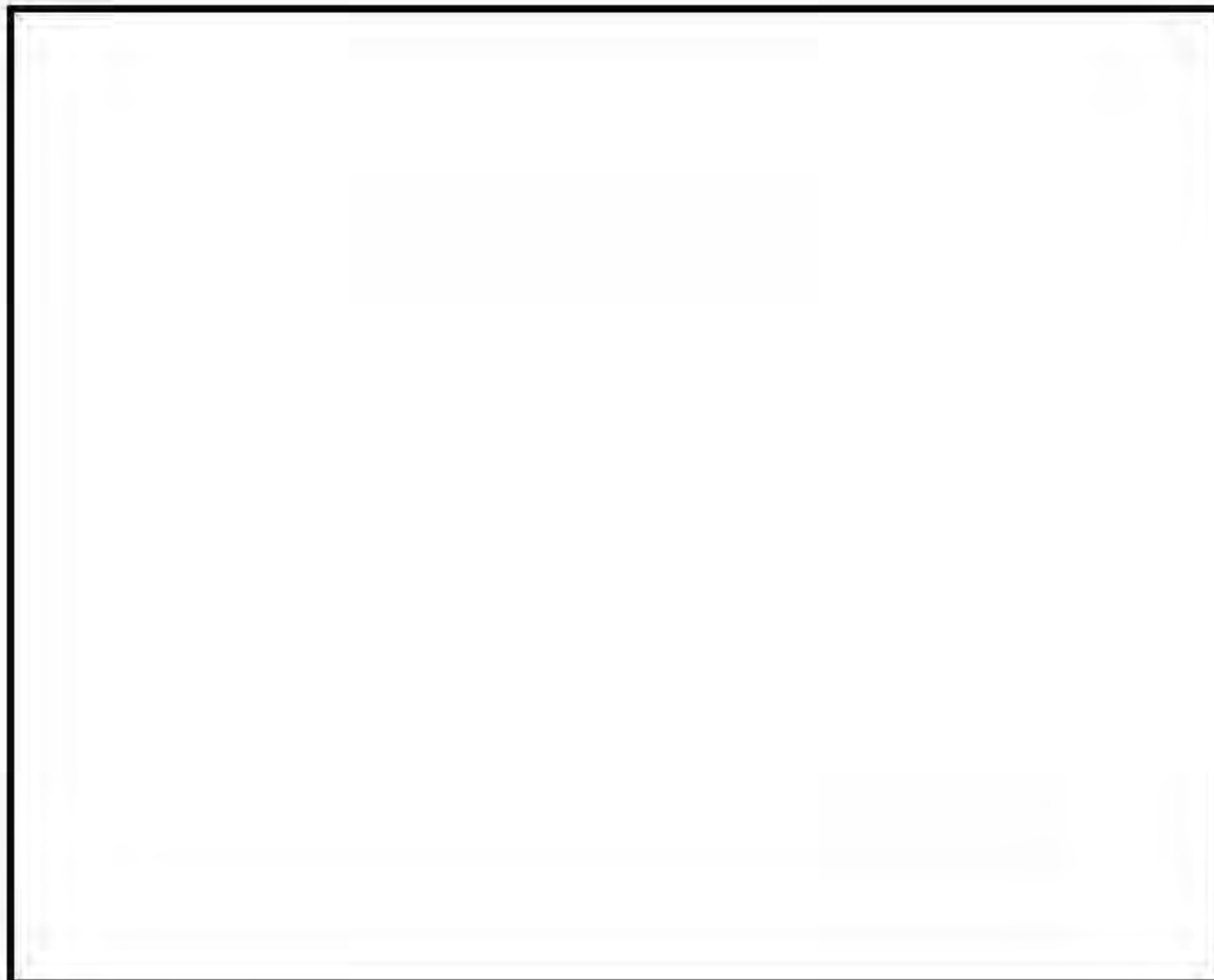
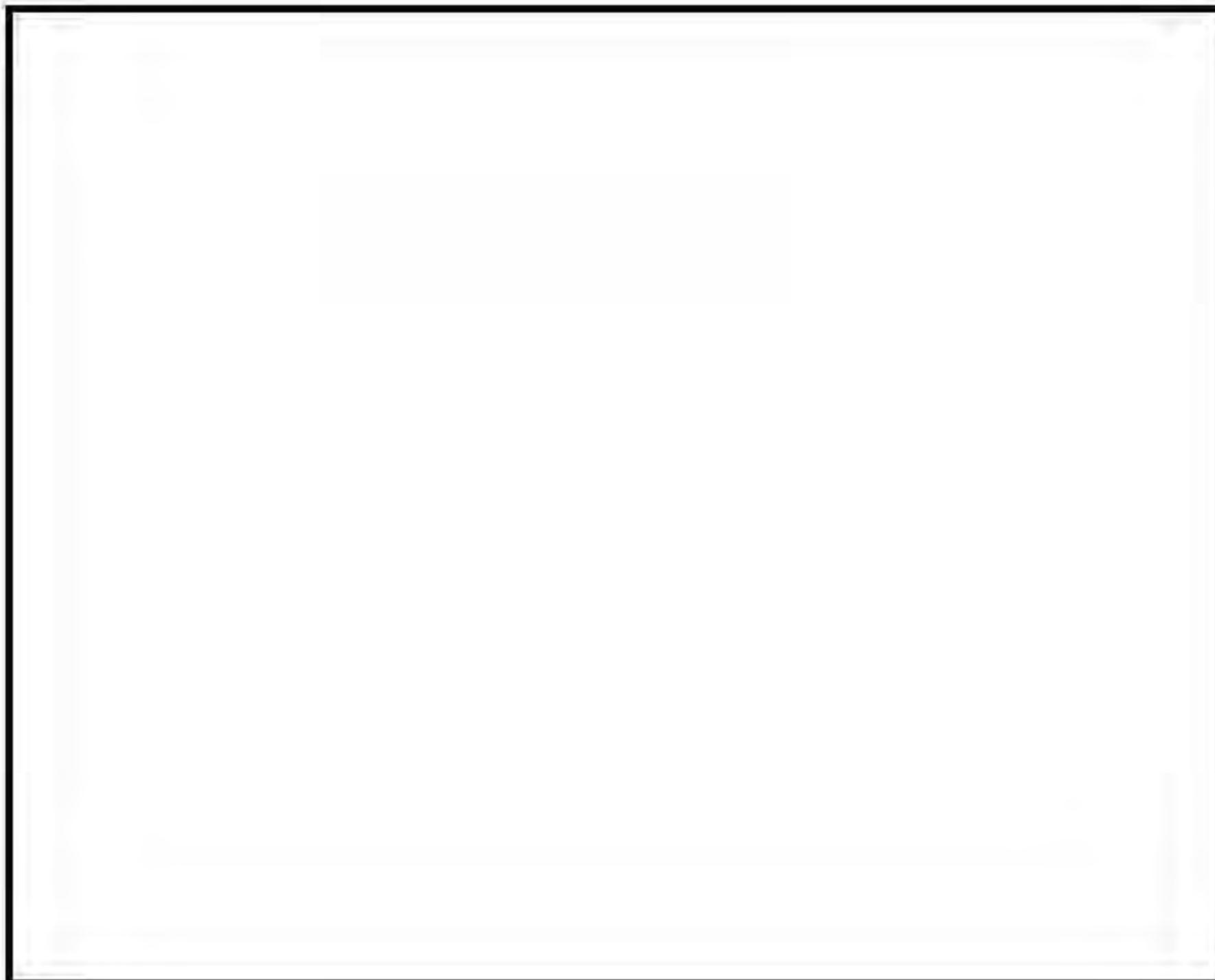
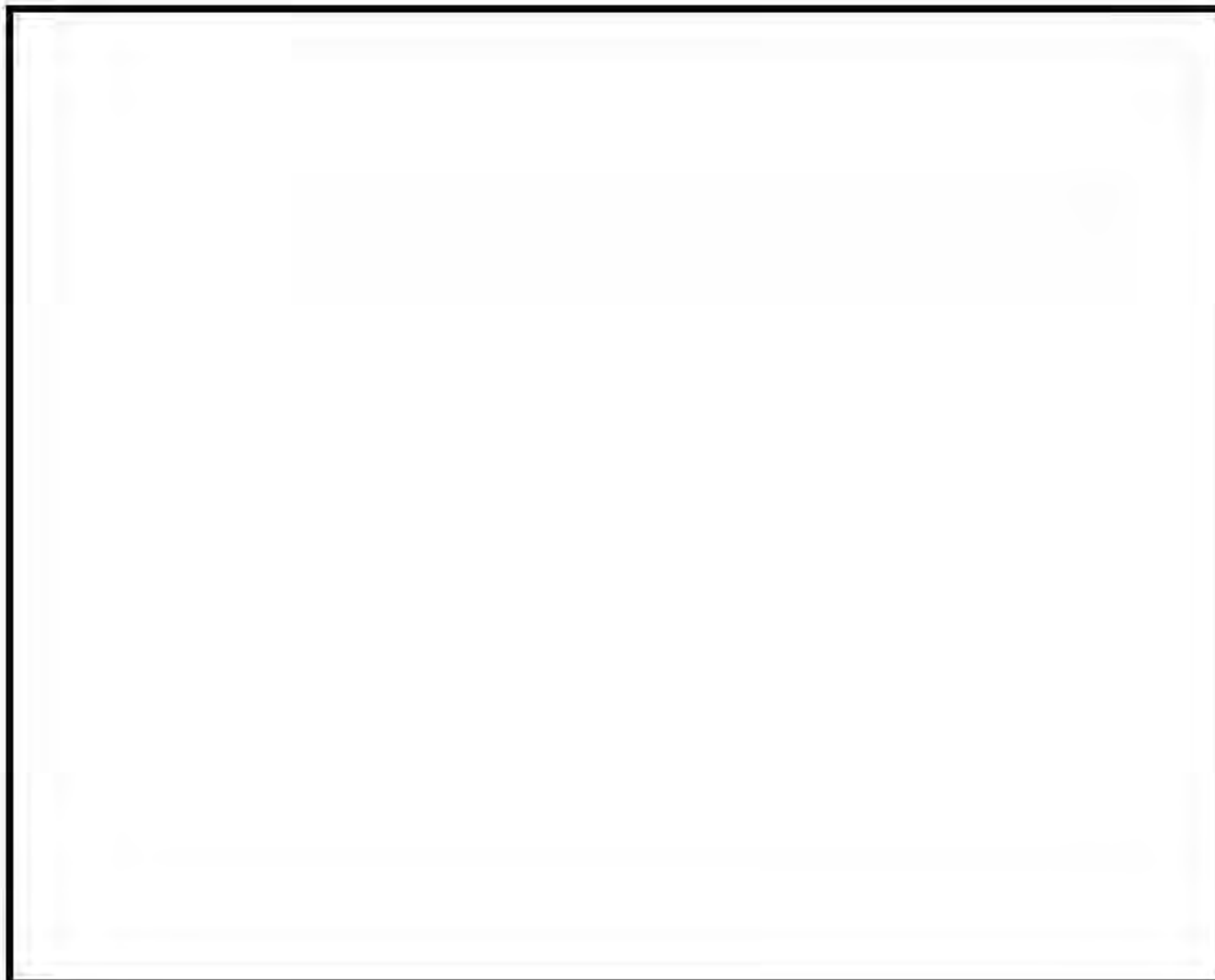
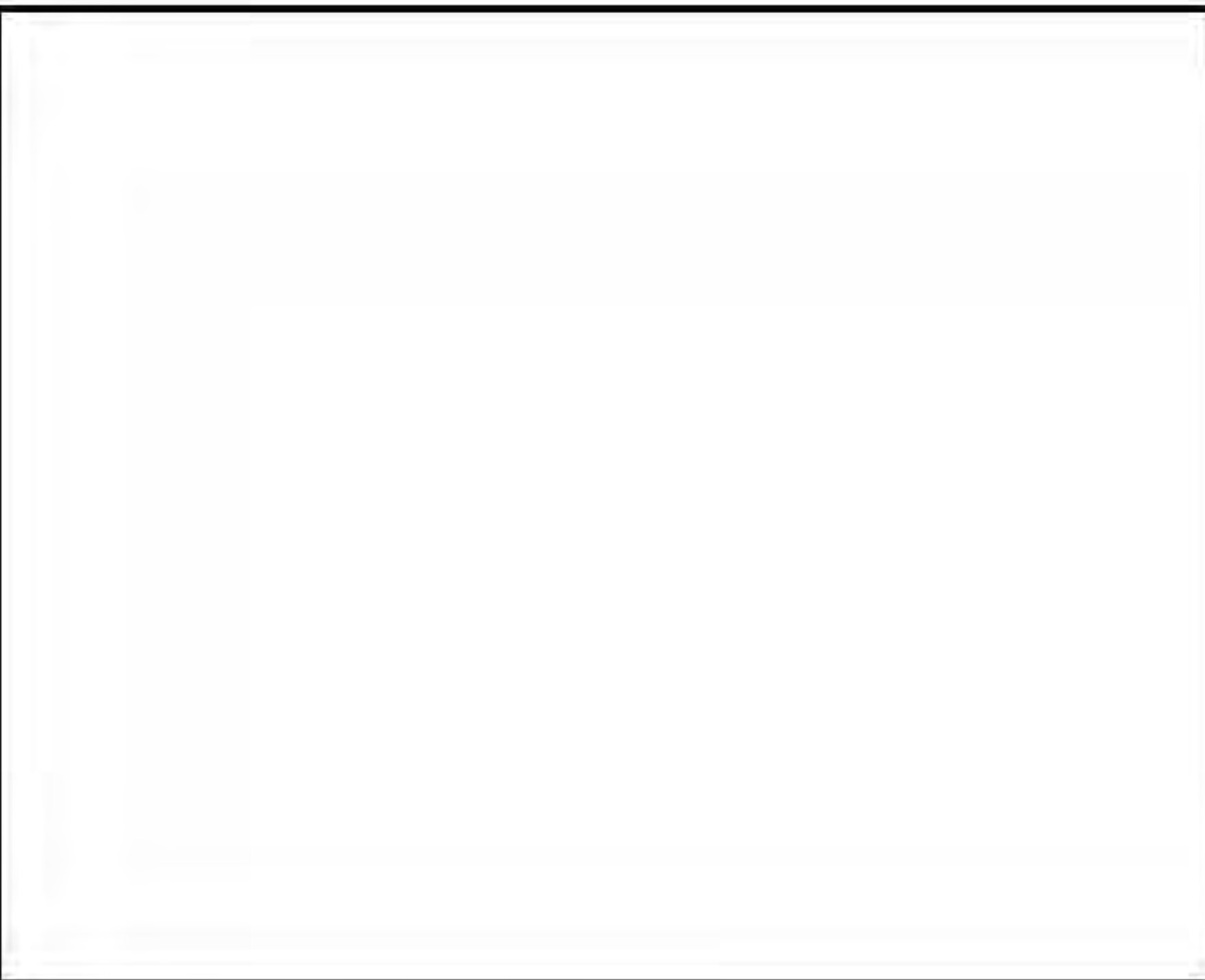
Data Evaluation - Facility Management of a Building

Improving Space Utilisation

Excluding Allocation Conflicts

Space Planning

Locking Systems, Key Management



Cost Control

Controlling Condition of the Building

Controlling Fire Protection

Requesting Reports



Cost Structure of a Building according to DIN Standard 276

300 Building - Construction

330 Exterior Walls

360 Roofs

310 Excavation Pit

340 Interior Walls

370 Constructive Fixtures

320 Foundation

350 Ceilings

390 Miscellaneous

100 Site

200 Preparation of Land for Building

300 Building - Constructions

400 Building - Technical Equipment

500 Outside Facilities

600 Fittings and Artwork

700 Ancillary Construction Costs

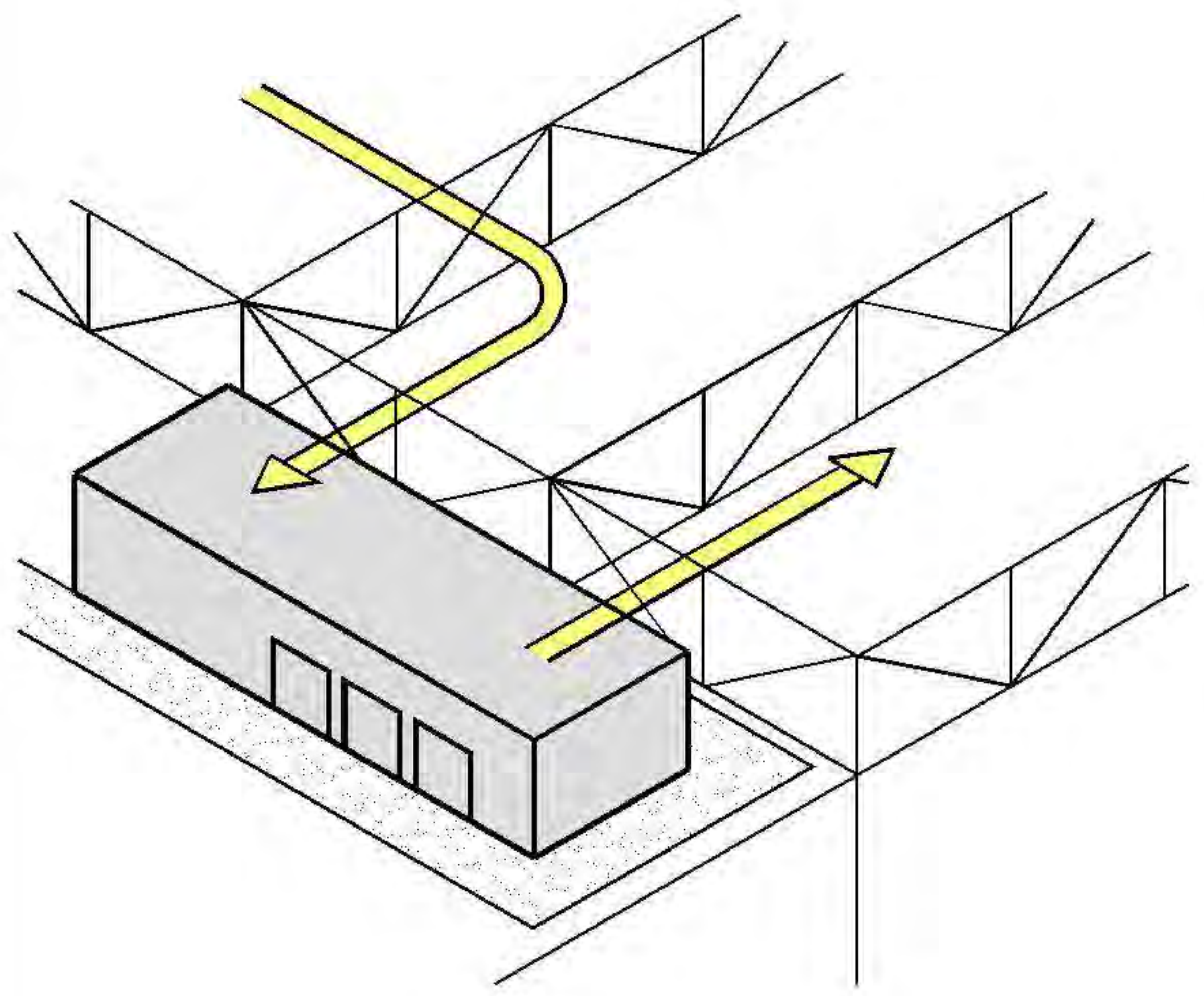
Code	DIN	Sub-Proj. New Factory	Flächen				Cubature			Guide Value Costs€ Net Sub-Project			
			Outside F	Areas A1	Areas A2	Gross Floor	Factor	SOI	GC	Construction	Building Service	Open Space	Total
	276	excl.Conv.of exist.Bldg	qm	Bereich qm	Rest qm	area qm	F1/BG	FSR	m3	Cost Group 300	Cost Group 400	Cost Group 500	Cost 3-500
		covered area				6.016,00							
		sealed outs.area logistic	2.640,00										
		sealed outside area	1.440,00										
		unsealed outside area	0,00										
		Total Side	4.080,00										
		production		4.750,00									
		despatch dep.		519,00									
		adaptor/ ramp		326,00									
		workshop		40,50									
		spare parts inventory		40,50									
		qs - lab		40,50									
		dayroom		20,00									
		first-aid room		20,00									
		(finish.conf. room option		42,00	plus								
		gs-loading room		44,00	total								
		wc - gents		10,00	operation area								
		wc - ladies		10,00	construct. Area								
					traf.area,stairw								
		Total Ground Floor		5.862,50	154,00	6.016,00							
		shell of building only, gal											
		lery, ceiling, connections											
		staircase / core 1		20,00									
		staircase / core 1		20,00									
		Total First Floor		40,00	0,00	40,00							
		contr.cent. air conditions											
		contr.cent. compr. air			plus								
		contr.cent. heating			total								
		(mainten. runways option			operation area								
					construct. Area								
					traf.area,stairw								
		Total Second Floor		500,00	80,00	580,00							
		Total Areas Project		6.402,50	234,00	6.636,00				6.636,00	6.636,00	4.080,00	
		Summe Cubature Proj.							60.963,00				
		Gui.Val./m2 Open Space										55,00	
		Gui.Val./m2 Gr.Fl.Area								405,00	100,00		505,00
		Gui.Val./m3 Gr. Cubage								44,09	10,89		54,97
		Total Gui. Val. Project								2.687.580,00	663.600,00	224.400,00	3.575.580,00
		zus. plus conversion/extension Existing								50.000,00	225.000,00	25.000,00	300.000,00
		control centres / assumptions											

Cost Centres Building Services according to DIN Standard 276

400	Building - - Technical Installations	Costs of all technical installations or their components fitted, connected or fixed to a building
410	Wastewater, Water, Gas Installations	drains, wastewater pipes, wastewater collectors, wastewater treatment, water harvesting, water conditioning, pressure-increasing systems, piping, local water-heating installations, sanitary ware
411	Wastewater Installations	
412	Water Installations	
413	Gas Installations	gas installations for operational heat: gas storage and gas production plants
420	Heat Supply Systems	fuel supply, heat transfer stations, heat production by fuel or inexhaustible energy sources
421	Heat-Producing Appliances	radiators, heated surfaces
422	Heat Distribution Networks	
423	Space Heating	
430	Aerial Engineering Plants	plants with and without ventilation function
431	Ventilation Systems	exhaust air plant, supply air plant, exhaust and supply air plants without or with thermodynamic air conditioning function
432	Partial Air Conditioning System	plants with two or three thermodynamic air conditioning functions
433	Air Conditioning System	plants with four thermodynamic air conditioning functions
440	High Voltage Installations	switchgears, transformers
441	High and Medium Voltage Systems	power generators including cooling, exhaust gas systems and fuel supply
442	Individual Power Supply Plant	low voltage main distributors, idle current compensation plants
443	Low Voltage Switchgears	individual systems include respective distributors, wires and conductors
450	Telecommunication and IT-Systems	
451	Telecommunication Systems	
452	Paging and Signalling Systems	onsite paging systems, visual and audible signals, door phones and door openers
453	Clocking Systems	time and clocking systems
460	Conveyor Plants	
461	Lifts	lifts, goods lifts
462	Escalators, Conveyor Belts	
463	Maintenance Lifts	building maintenance systems and other maintenance lifts
470	Installations for Specific Uses	Costs of those installations fixed to a building that serve special purposes, however excluding structural fixtures (cost group 370)
471	Kitchen Technology	equipment for preparing, handing out and storing of food and drinks, respective cooling systems including respective water conditioning, disinfection and sterilisation systems
472	Laundry and Purification Plants	
473	Media Supply Systems	medical and technical gases, vacuum, liquid chemicals, solvents, demineralised water; including storage, production plants
480	Building Automation	costs of inter-equipment automation including respective distributors, wires and conductors
481	Automation Systems	automation stations, operating and monitoring facilities, programming facilities, sensors and actors, communication interfaces, software at automation stations
482	Performance Components	switch cabinets with performance modules, control units and fuse modules
483	Central Facilities	control stations with peripheral equipment, equipment for system communication to automation stations
490	Miscellaneous Measures for Technical Installations	comprehensive measures concerning technical installations that cannot be allocated to individual cost groups of technical installations or cannot be recorded in other cost groups
491	Site Facilities	set-up, provision, operation and vacation of superordinate site facilities
492	Scaffolding	set-up, provision, alteration and dismantling of scaffolding
493	Safeguarding Measures	safeguarding measures at existing buildings, e.g. underpinnings, supports

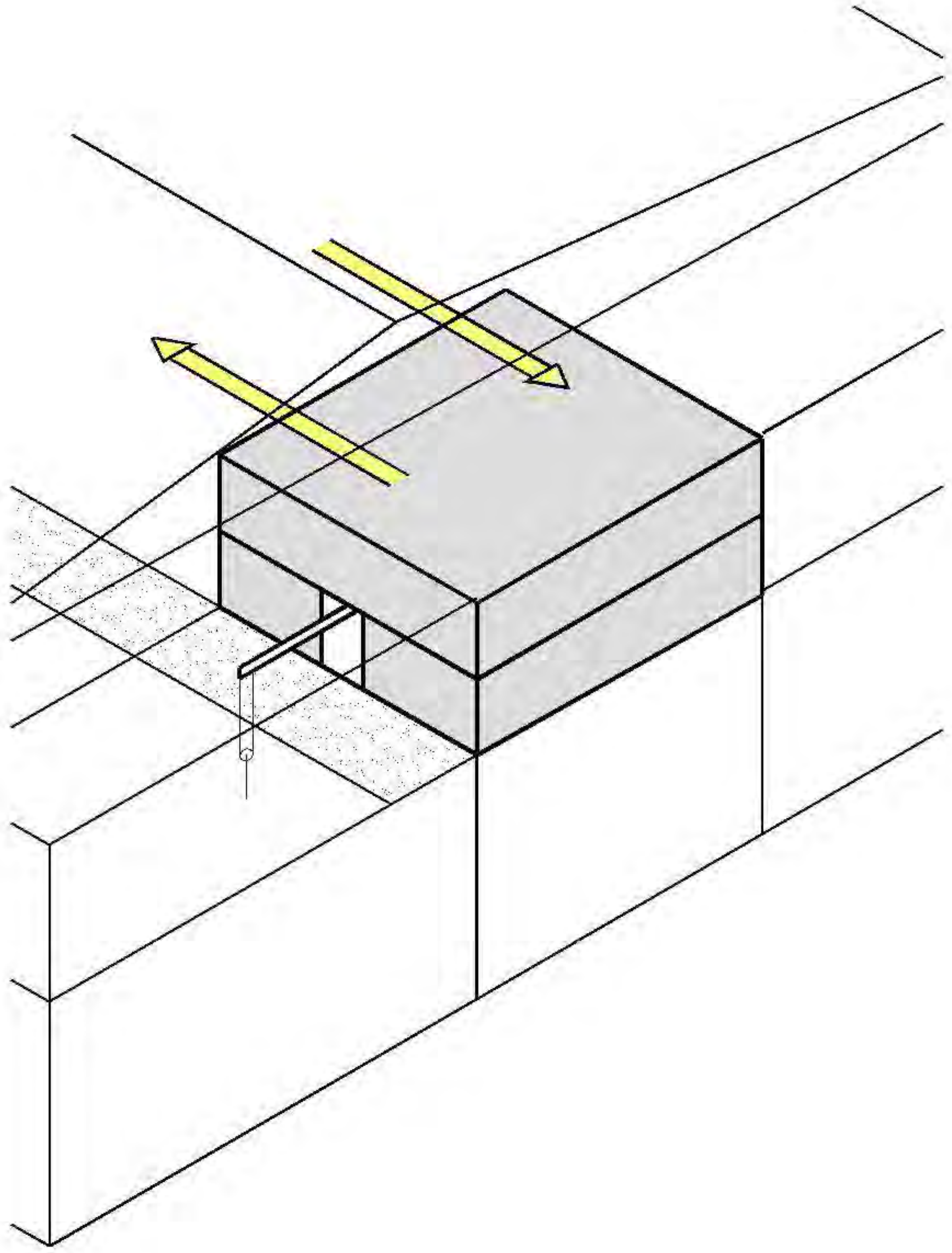
Positioning of Control Centres, Examples

Assembly Plant for Coolant Systems



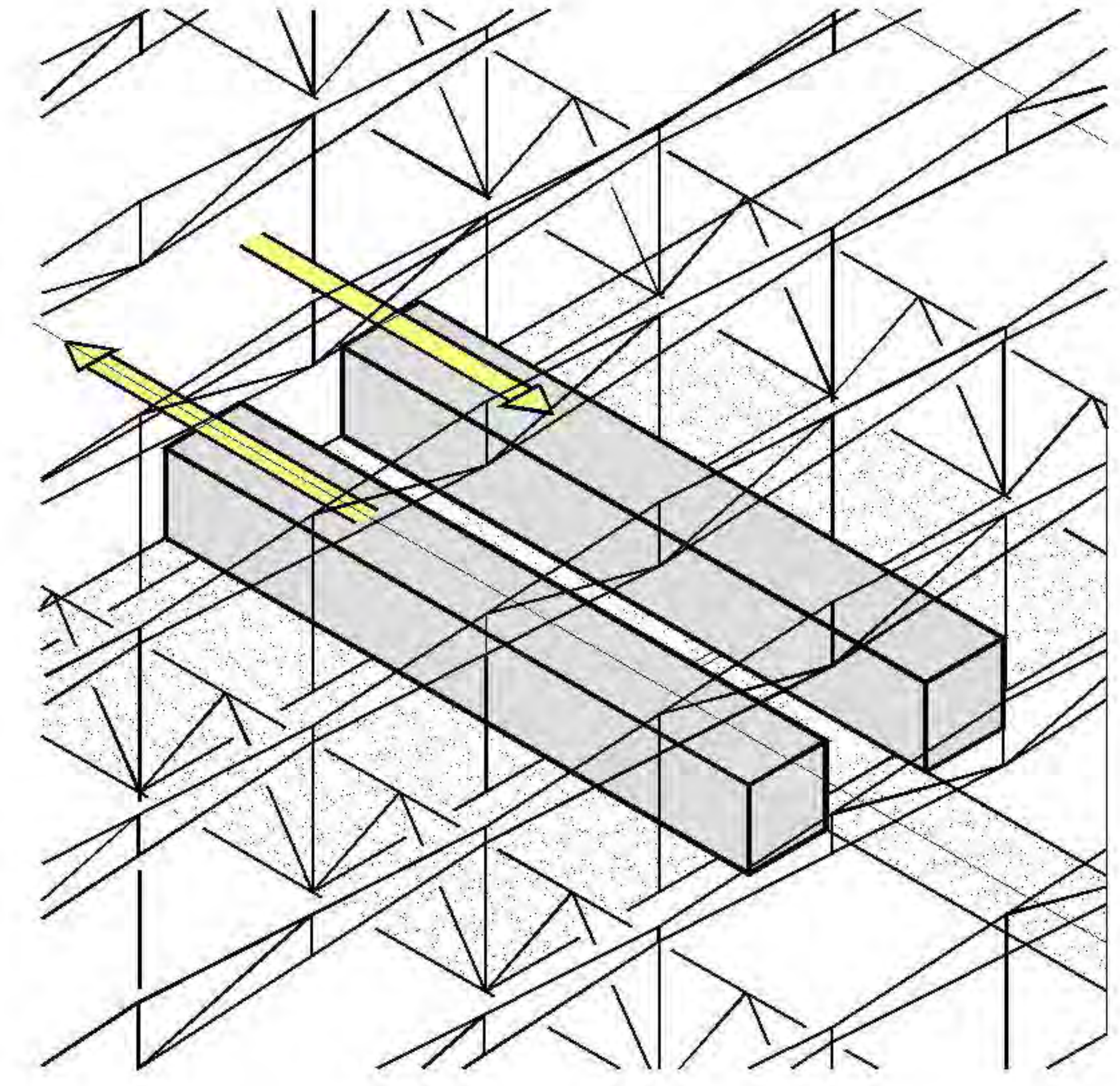
Access/Maintenance partially via interior of hall

Assembly Plant for Engines



Access/Maintenance exterior only

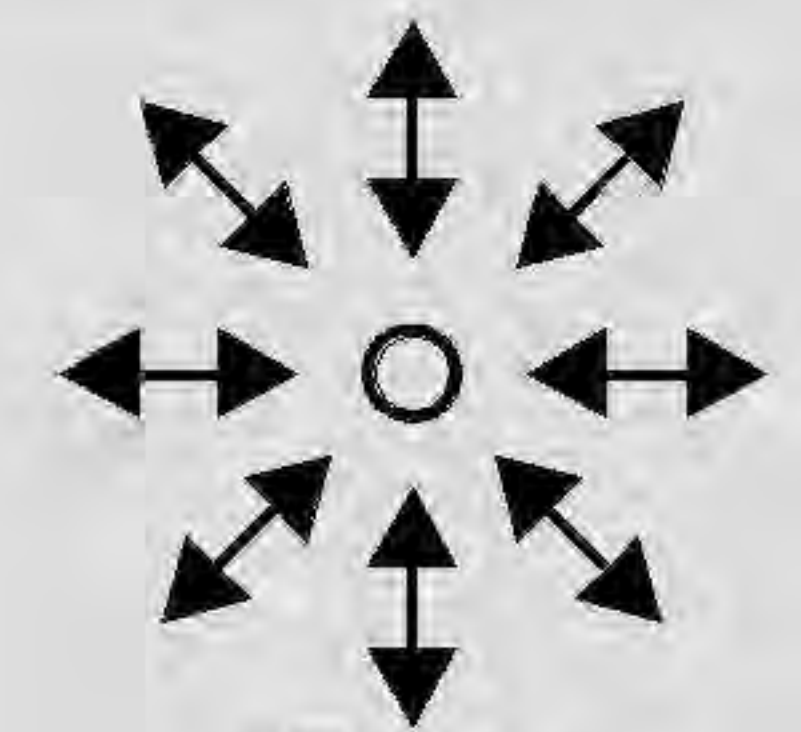

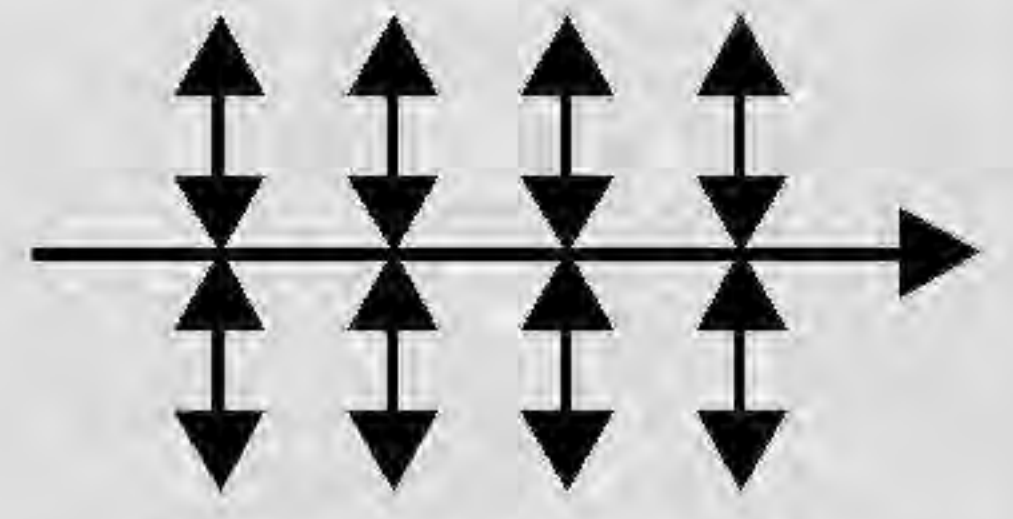
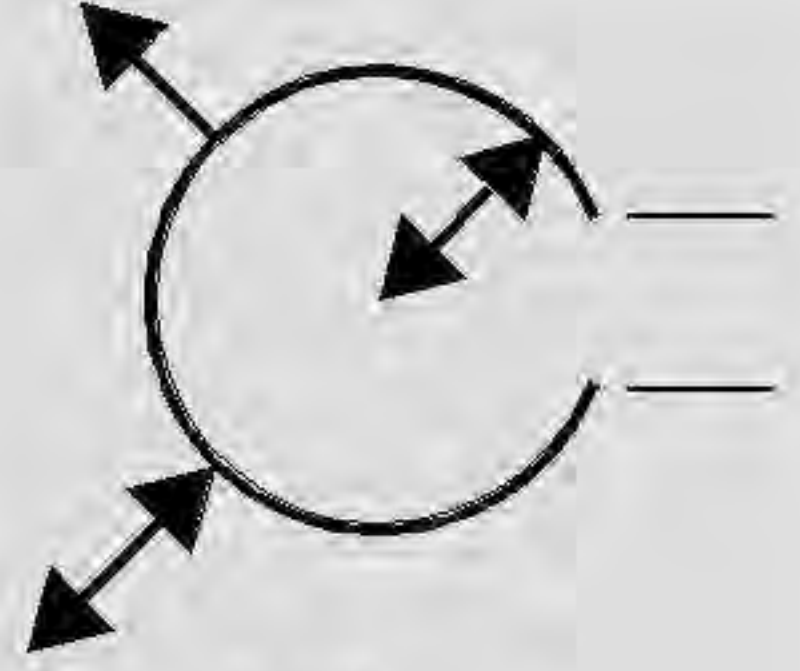
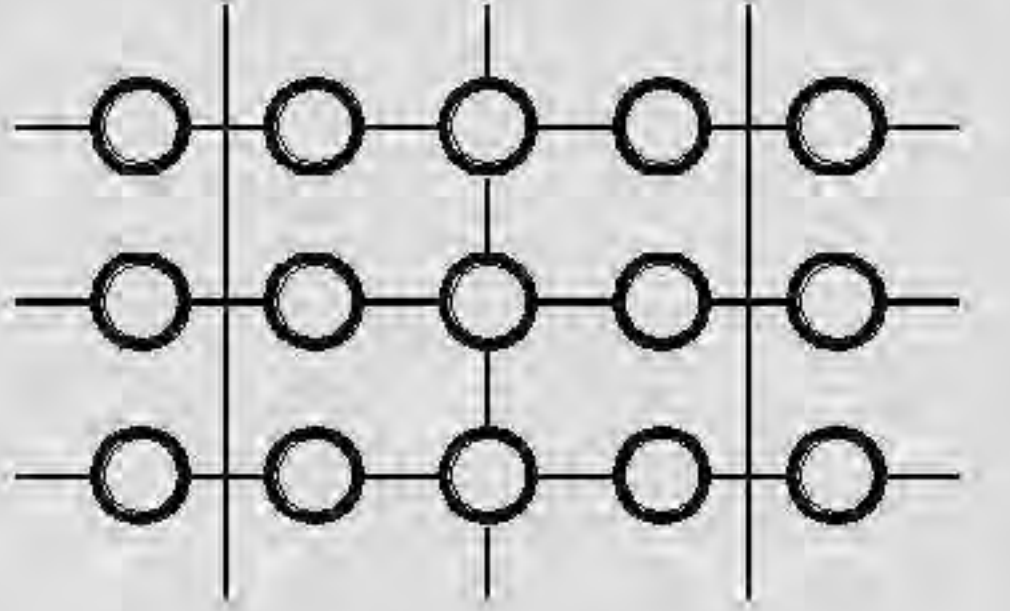
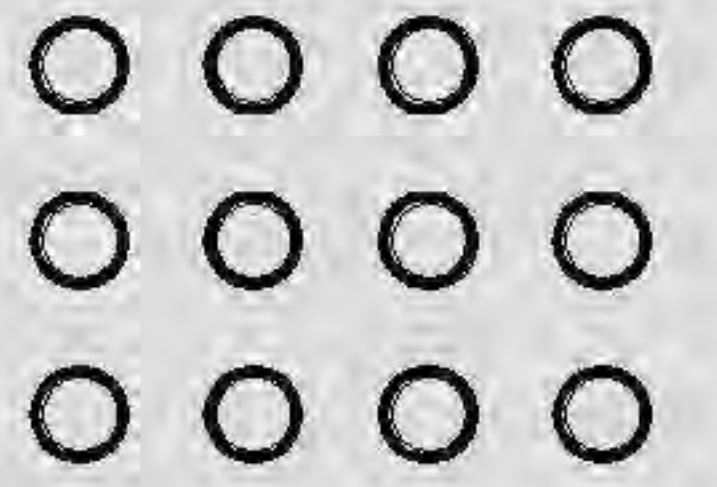
Tyre Fabrication: Gallery incorporated in Load Bearing Structure



Access/Maintenance interior via gallery and maintenance runways

Advantages and Disadvantages of Distribution Structures for Media

[according to Reinhard]

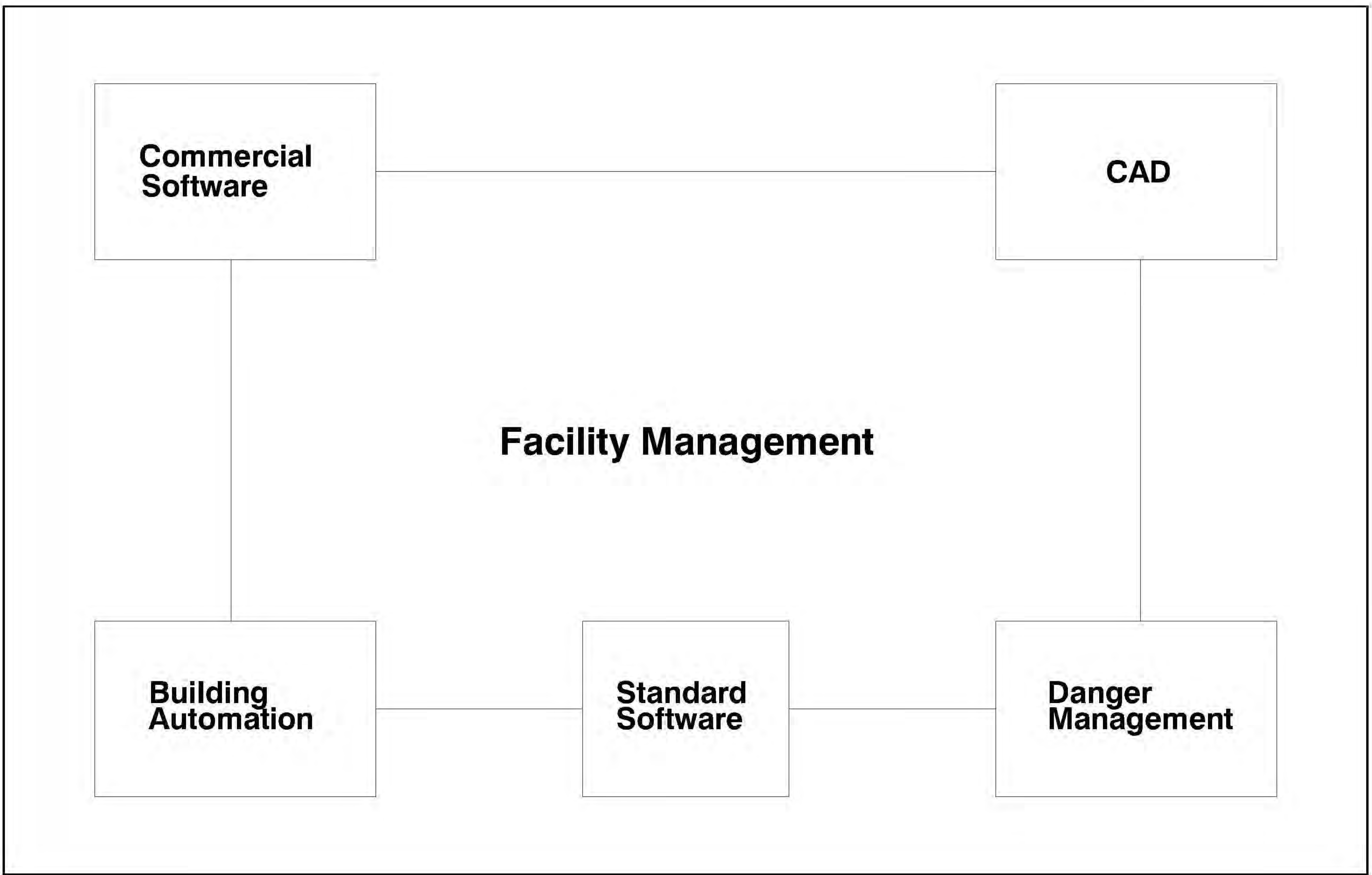
	 Star	 Ordinary Longitudinal Flow	 Ramified Longitudinal Fl.	 Ring	 Network	 Punctual, Vertical
Reliability	+ +	- -	+	-	+ +	+ +
Dependency Machine Positioning	enables flexible positioning of machines	machine pos. sensible linear only	branches optional extensible (low dependency)	adding branches optional limited by ring	no dependency	supplying as needed
Extension Flexibility	central point extension limited (poor extensibility)	good extensibility within lines further structures impossible	very good extensibility	circular shape extension limited (poor extensibility)	circular shape extension limited (poor extensibility)	very good extensibility
Extension Complexity	duplication of structure as of certain level (high complexity)	duplication of line (low extension complexity)	low extension complexity	low extension complexity	construction kit principle (low extension complexity)	high extension complexity
Conveying Distance	short	short - medium	medium	long (encircling production)	very long	very short
Installation Complexity	star structure deviant to hall structure many modules (medium to high installation compl.)	straight lines in accordance with hall structure (low installation complexity)	many outlets and intersections (medium installation complexity)	many outlets and intersections (medium to high installation compl.)	very high installation complexity	high installation complexity
Suitability	central	central / local	central / local	central	central / local	local
Blocking Off Levels	very adverse - area-wide structure in one level	low at advantageous positioning (linear structure)	adverse - area-wide structure in one level, linear structure good	adverse - area-wide structure in one level	adverse - area-wide structure in one level	no blocking off
Maintenance	many single modules	good	many single modules	many single modules		intensive of staff, because wide apart

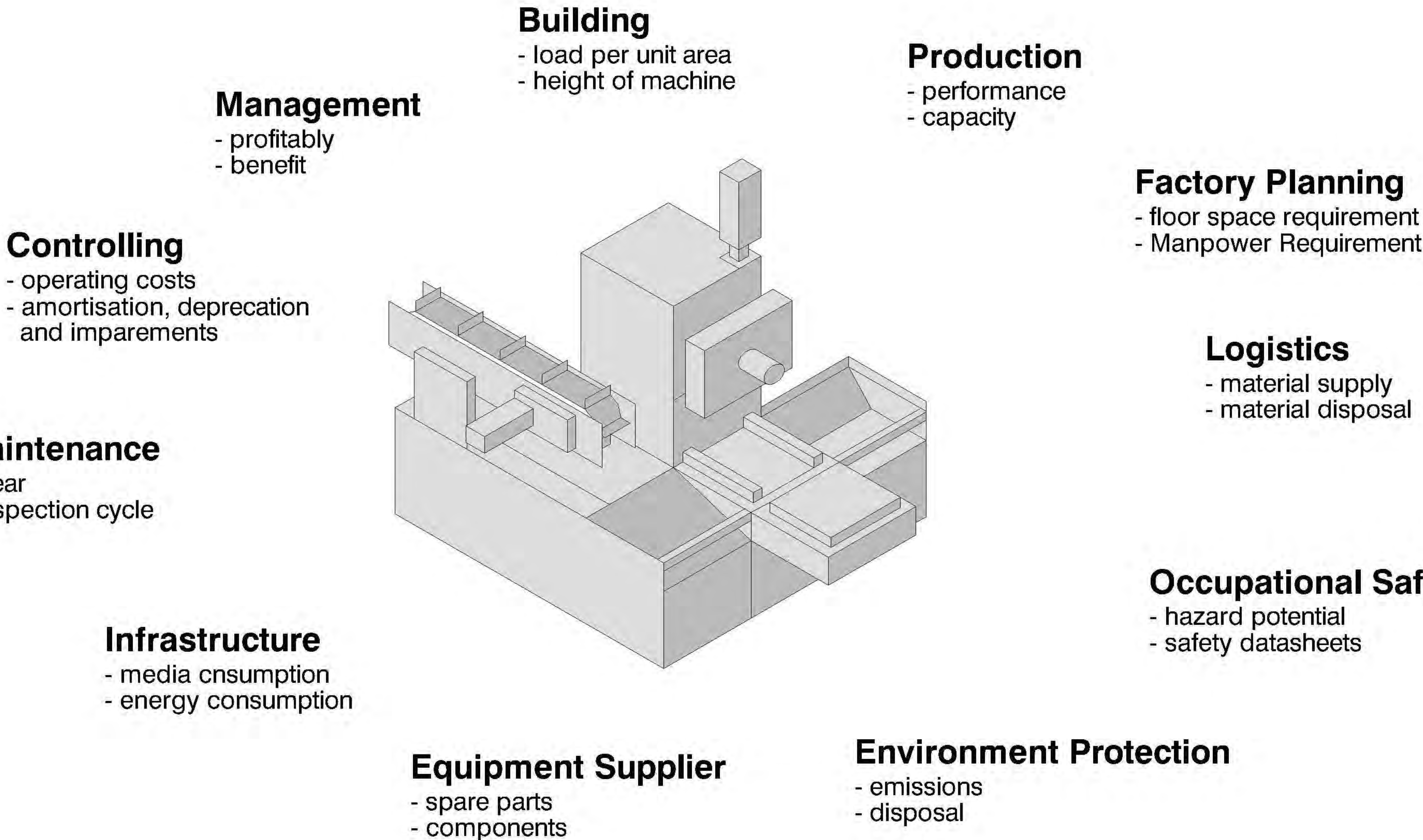
Examples for Processes of Technical Facility Management

[according to Krimmling]

Process	Objectives	Contents
Malfunction Management	<ul style="list-style-type: none"> • Shortening of downtime • Increase of availability 	<ul style="list-style-type: none"> • Objective / Definition of malfunctions • Recording malfunctions • Evaluation / Classification • Reaction subject to evaluation • Control • Documentation
Energy Controlling	Lowering of energy costs	<ul style="list-style-type: none"> • Presetting Budgets • Recording Deviations • Evaluation / Classification • Reaction subject to evaluation • Control • Documentation
Repair Order	On schedule and efficient execution of repair work	<ul style="list-style-type: none"> • Determining requirement • Placing of order (internal or external) • Execution • Control • Costs Allocation • Documentation

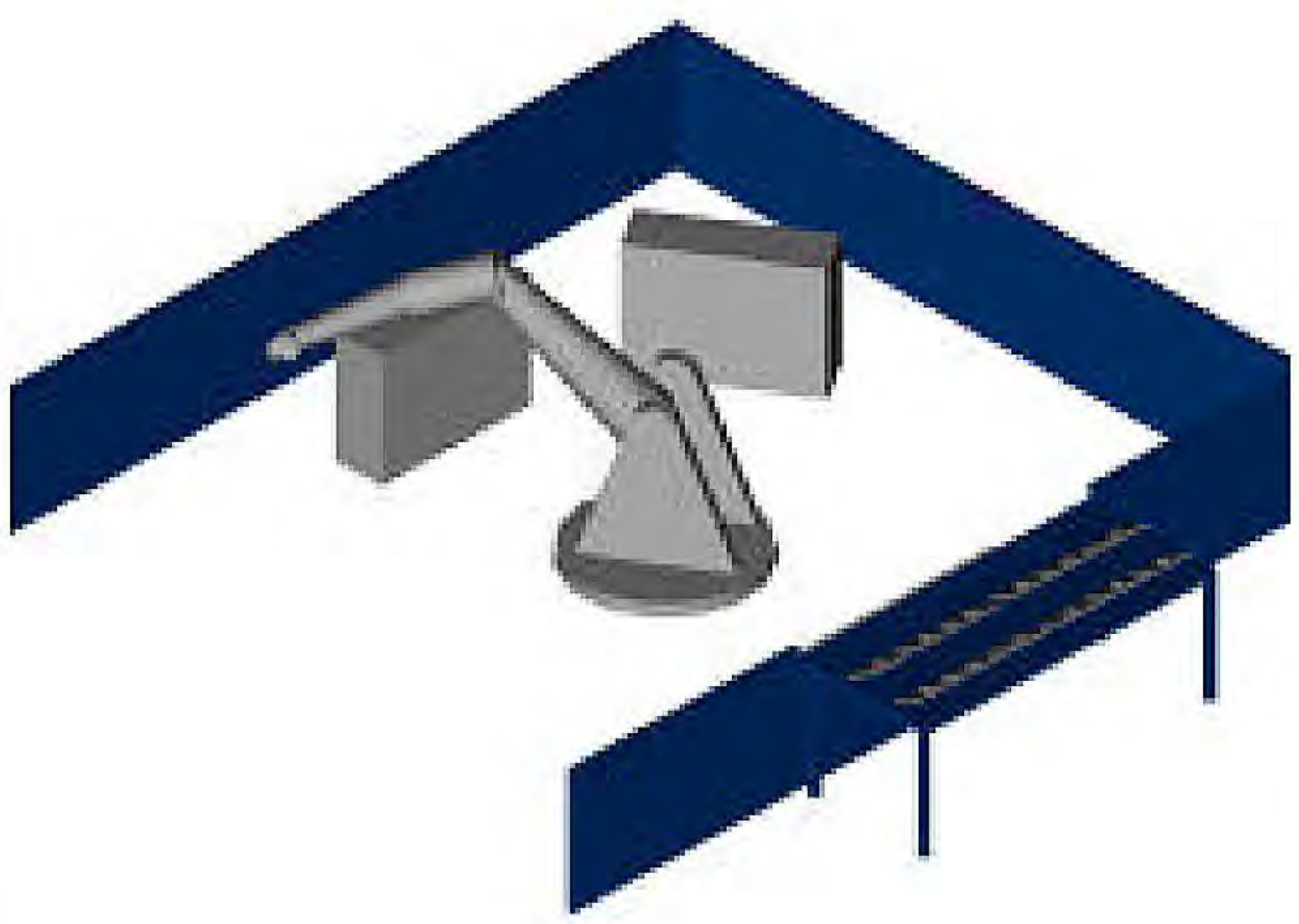
Interfaces to Building Automation and Danger Management





ID - Card Cleaning Robot

3D - Illustration



Side Elevation

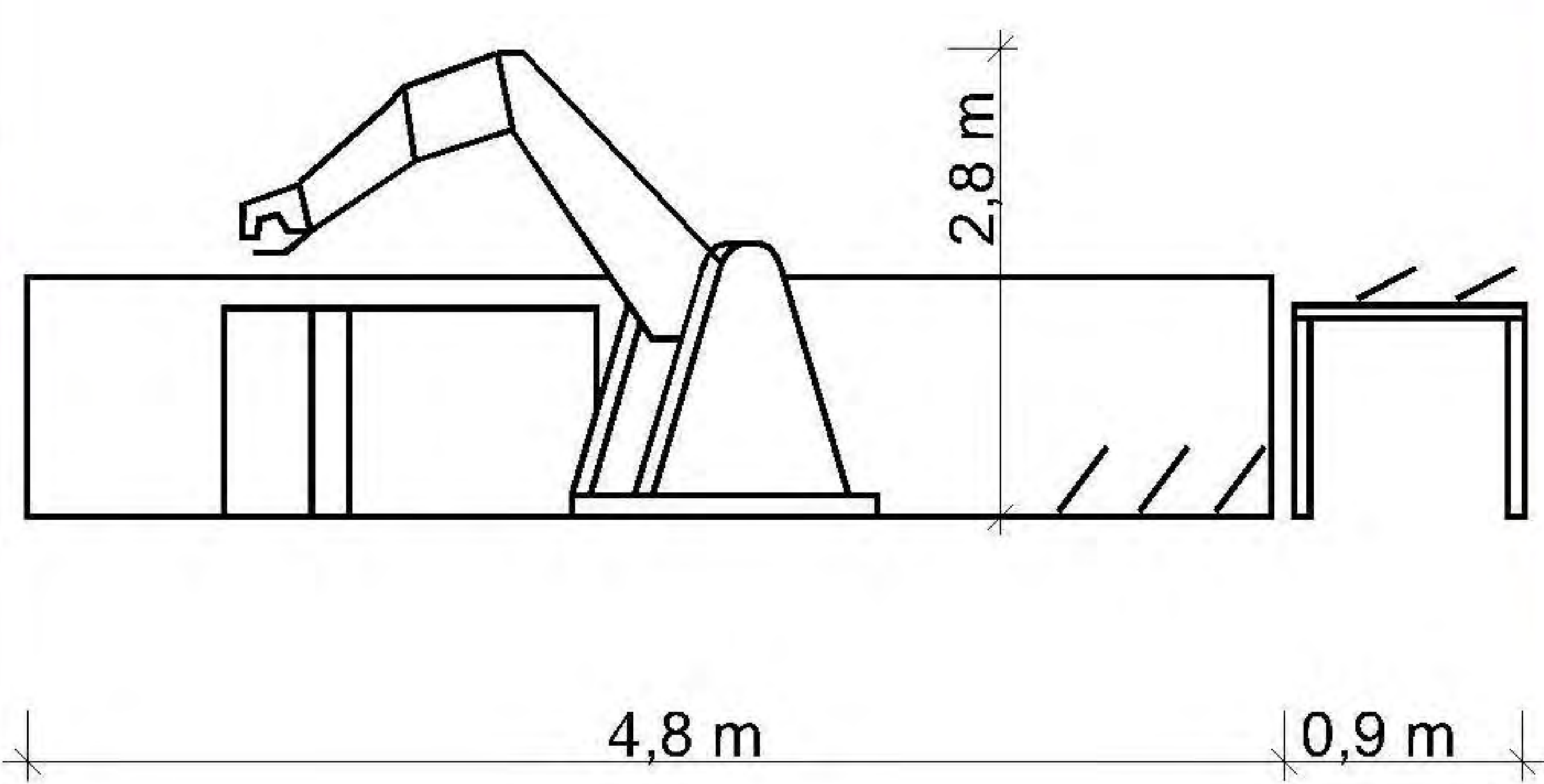
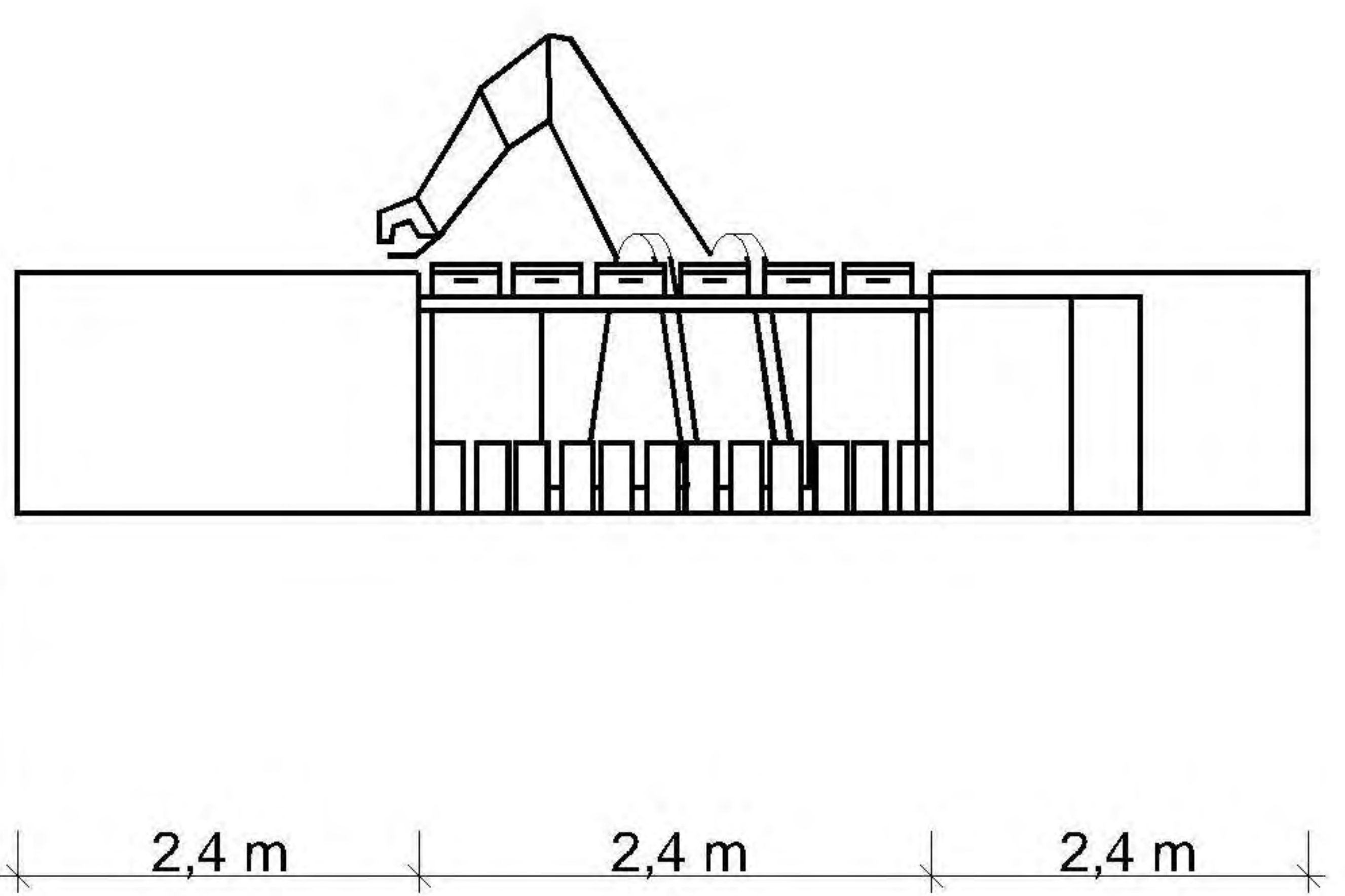


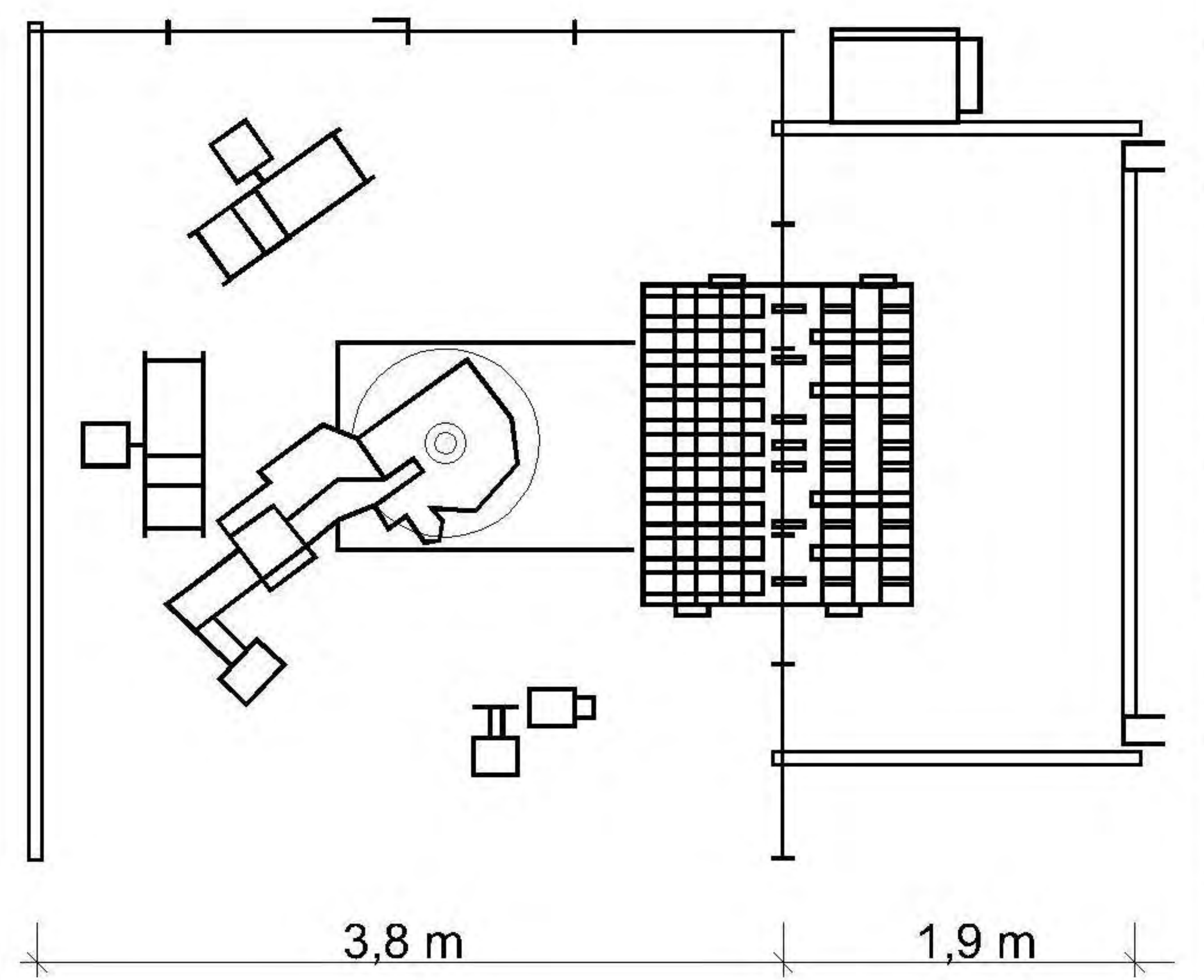
Photo / Picture



Side Elevation



Floor Plan



Geometry

Length	7,2 m	Crane	10 t
Width	5,7 m	Belt	
Height	2,8 m	Forklift	
Floor Space	41 m ²	Tools	
Operating Space	41 m ²	Operating Space	
Total Space	41 m ²	Set-up Time	15 min.
Weight	<50 kN/m ²	Cycle Time	

ID - Card Degreasing Machine, Media Connections

3D - Illustration	Media Connec.	Side Elevations	Media Connec.	Media	Energy Requirem.	
				1	Electric	Connections Value Electricity
				2	Steam	
				3	Compressed Air	Connections Value Heating
				4	Gas	
				5	Process Water	Connections Value
				6		
				7		Synchrony Factor
				8		

Side Elevations	Media Connec.	Floor Plan	Media Connec.	Emission	Miscellaneous	
				Exhaust Air	Condensate	Maintenance
				Sound		Fire Protection
						Explos.-Protection
						Air Condition

FM - figure 2.18