TU Delft
Onderzoeksinstituut OTB

2nd seminar on automated methods of mass appraisal and market analysis

November 1, 2007

OTB Research Institute for Housing, Urban and Mobility Studies

Real Estate & Sustainability Assessment

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&

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Chair of Sustainable Management of Housing and Real Estate

Seminar Goal

"Examine the market base of property value and processes shaping it"

Tom Kauko

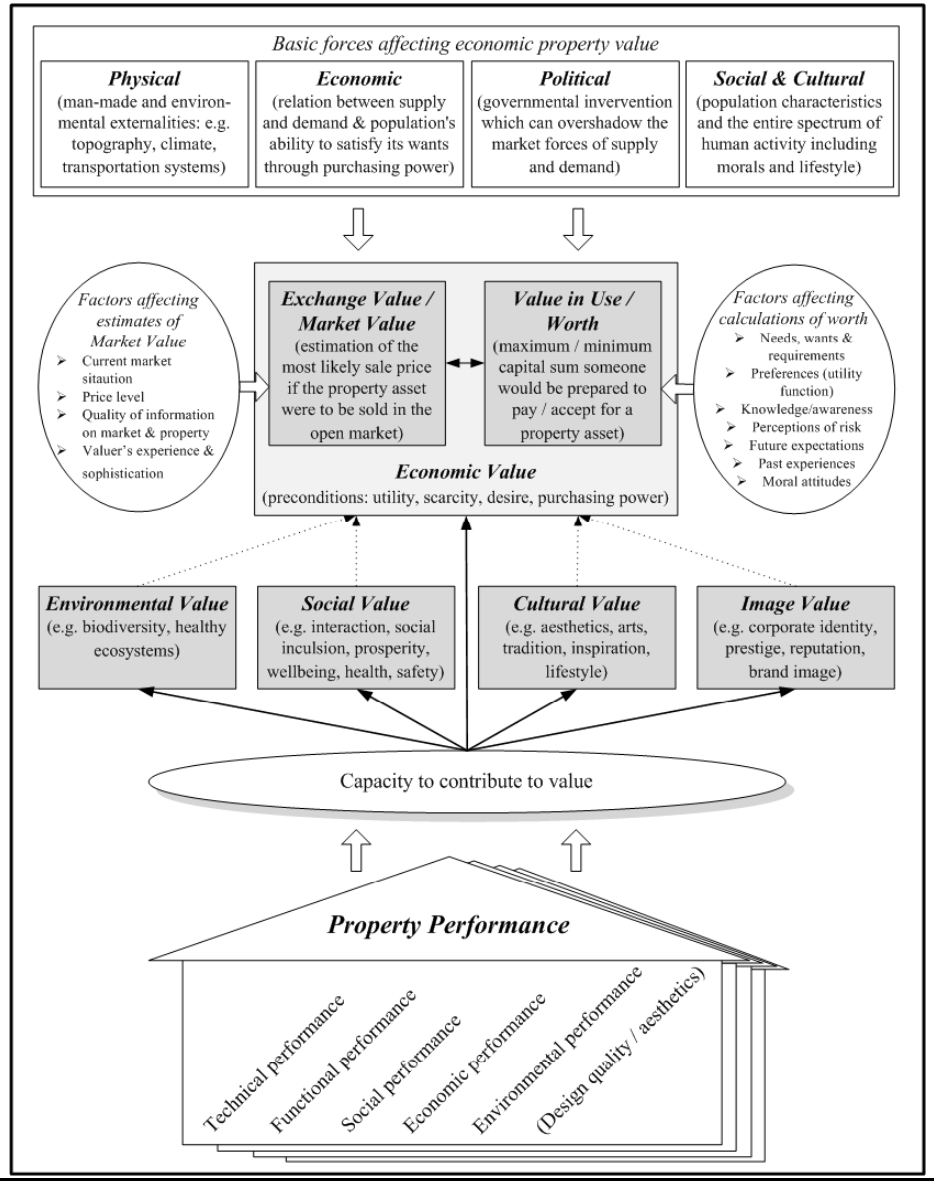
What is done to achieve this: Property price and market analysis to

(1) understand and explain the price formation of property assets,

(2) isolate and quantify the impact of different physical and locational characteristics on property prices, and

(3) account for changes in the price formation process across regions or over time.

Different aspects of property value

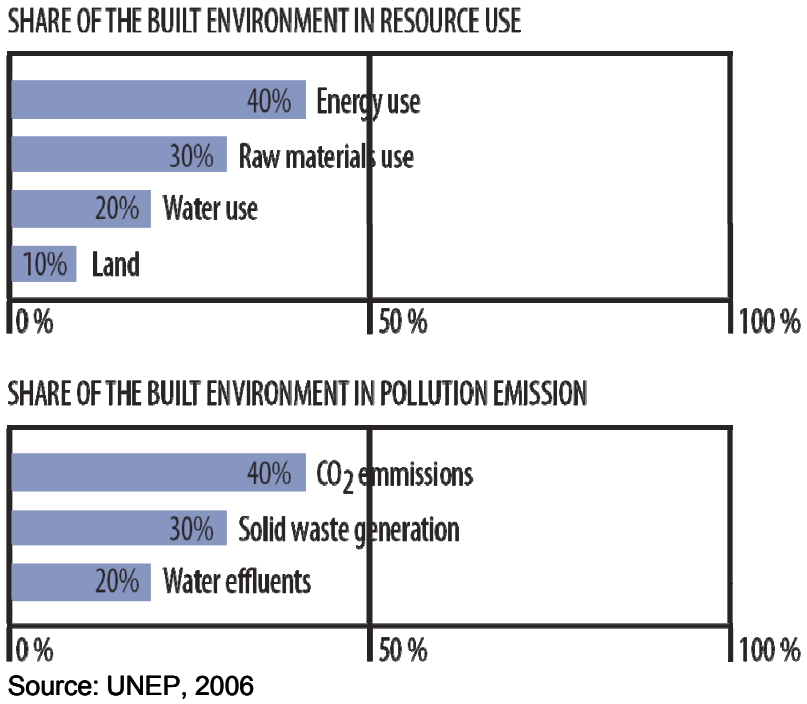


But:

"Are we linking property price information with appropriate data in order to be able to capture the changing market base of property value?"

Integrating Sustainability Issues into Property Valuation and Rating

The rationale:



Source: UNEP, 2006

➡ In OECD countries the built environment is the largest single cause for resource use and pollution emission!

- Growing awareness of the need for more sustainable development among the general public
- Benefits of sustainable design are increasingly being recognized by property market participants
- Changing occupier demands
- Increasingly stringent environmental legislation
- Mainstreaming of socially responsible investment (SRI) in financial markets & availability of first “green” REITs and property funds

➡ Changing market environment affects the way property has to be treated for valuation, lending and other decision-making purposes

Examples for forces that affect property value:

- ***Political and governmental actions*** *are currently changing to emphasize the need for more sustainable development in nearly all areas of human economic activity (see the EU Thematic Strategy on the Urban Environment).*
- *Peoples' **moral attitudes** – particularly in mature economies – impact on buy and sell decisions and the **awareness of sustainable design benefits** is likely to change the nature of housing and commercial property demand:*

  - 92 % of German citizens consider environmental protection important (BMU, 2004).

  *- Between 80 and 90 % of German building owners take the view that an improvement of their buildings' energy performance will lead to **increase in the buildings' market value** (Kraus, 2005).*

  *- Major corporate occupiers and investment firms in the UK are beginning to want **more sustainable buildings** (St. Lawrence, 2004).*

  *- Poor environmental and social performance is increasingly being seen as an **investment risk** or as a reason for not buying or renting a commercial or residential premise (Filose, 2005)*
- ***Availability*** *of first 'green' or 'sustainable' Real Estate Investment Trusts (REITs) and property investment funds. Examples include: Liberty Property Trust, Investa Property Group, Hermes, Land Lease, Prudential and Land Securities*

Analysis of current situation: overview

Several groups of actors increasingly aim integrating sustainability considerations into decision making processes relating to property and construction.

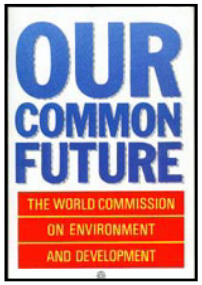
Groups of actors	Needs and requirements
➢ Governments and public bodies ➢ Corporations ➢ Banks ➢ Insurance companies ➢ Rating agencies ➢ Institutional investors ➢ Providers of investment funds and trusts	➢ Demonstration of leadership ➢ Basis for subsidy programs and tax schemes ➢ Basis for special lending and insurance conditions ➢ Basis for the development and assess-ment of new products (e.g. green REITs) ➢ Demonstration of compliance with Corporate Governance / Social Responsibility issues

➡ Growing demand for methods and tools to assess single buildings' contribution to sustainable development!

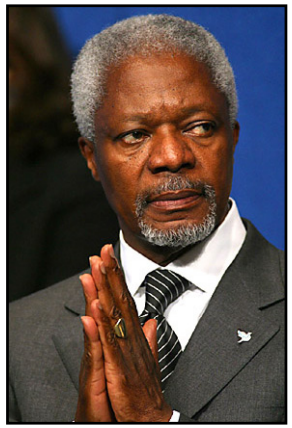
From Brundtland to Annan – Sustainability becomes a business case

***Sustainable development*, as defined by the Brundtland Commission (1987) is "development that meets the needs of the present without compromising the ability of future generations to meet their own needs".**

Norwegian Prime-Minister Gro Harlem Brundtland

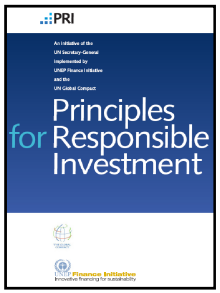


Brundtland-Report „Our Common Future“
World Commission on Environment and Development 1987



Kofi A. Annan

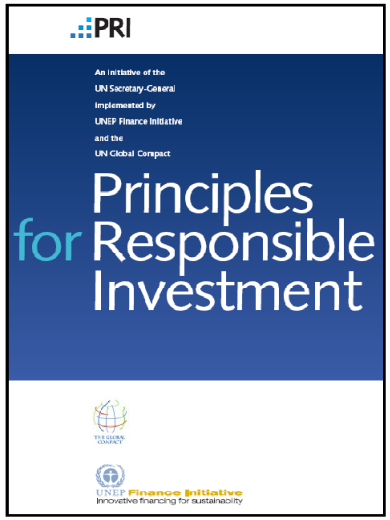
Principles for Responsible Investment
UNEP Finance Initiative and the UN Global Compact 2006



„... The predominant factor has been the absence of a <u>set of common guidelines</u> that individual and institutional investors can use <u>to assess risks and opportunities</u> fully. The Principles for Responsible Investment respond to this need.“...

The Principles for Responsible Investment

As institutional investors, we have a duty to act in the best long-term interests of our beneficiaries. In this fiduciary role, we believe that **environmental, social, and corporate governance (ESG) issues** can affect the **performance of investment portfolios** (to varying degrees across companies, sectors, regions, asset classes and through time). We also recognise that applying the Principles may better align investors with broader objectives of society. Therefore, where consistent with our fiduciary responsibilities, we commit to the following:



1. We will incorporate ESG issues into **investment analyses** and **decision-making processes**.
2. We will be active owners and incorporate ESG issues into our **ownership policies and practices**.
3. We will seek appropriate disclosure on ESG issues by the entities in which we invest.
4. We will **promote** acceptance and implementation of the Principles within the investment industry.
5. We will work together to enhance our effectiveness in implementing the Principles.
6. We will each **report** on our activities and progress towards implementing the Principles.

Ongoing activities amongst others …. (overview)

How to assess the „sustainability“ of buildings ?

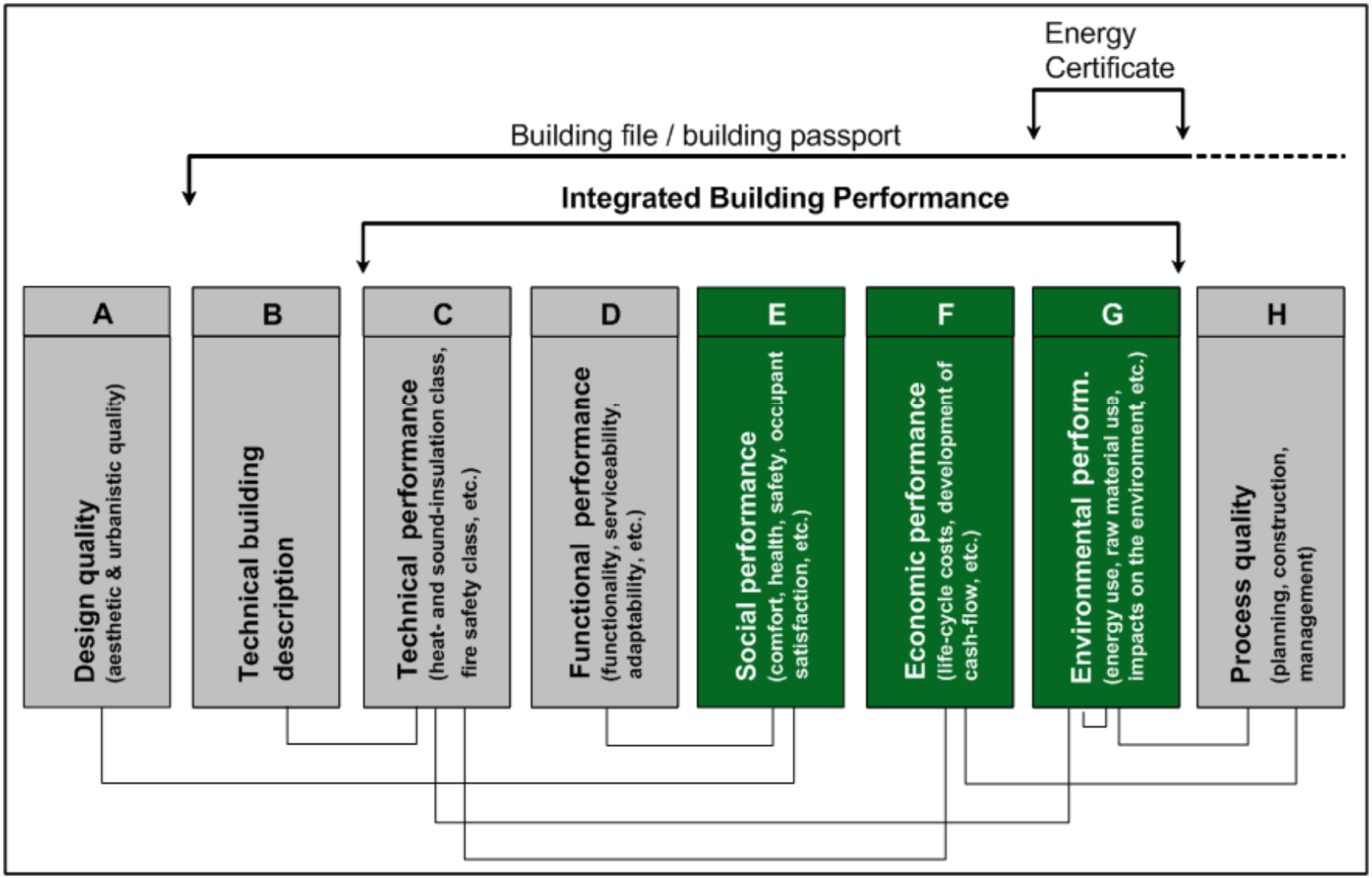
a) description **b) assessment**

	impacts on environment	impacts on economy	impacts on society
functionality		■	■
adaptability	■	■	■
longevity/durability	■		
energy efficiency	■	■	
indoor conditions	■	■	■
maintainability	■	■	
design quality			■
others …			
	■	■	■

assessment result

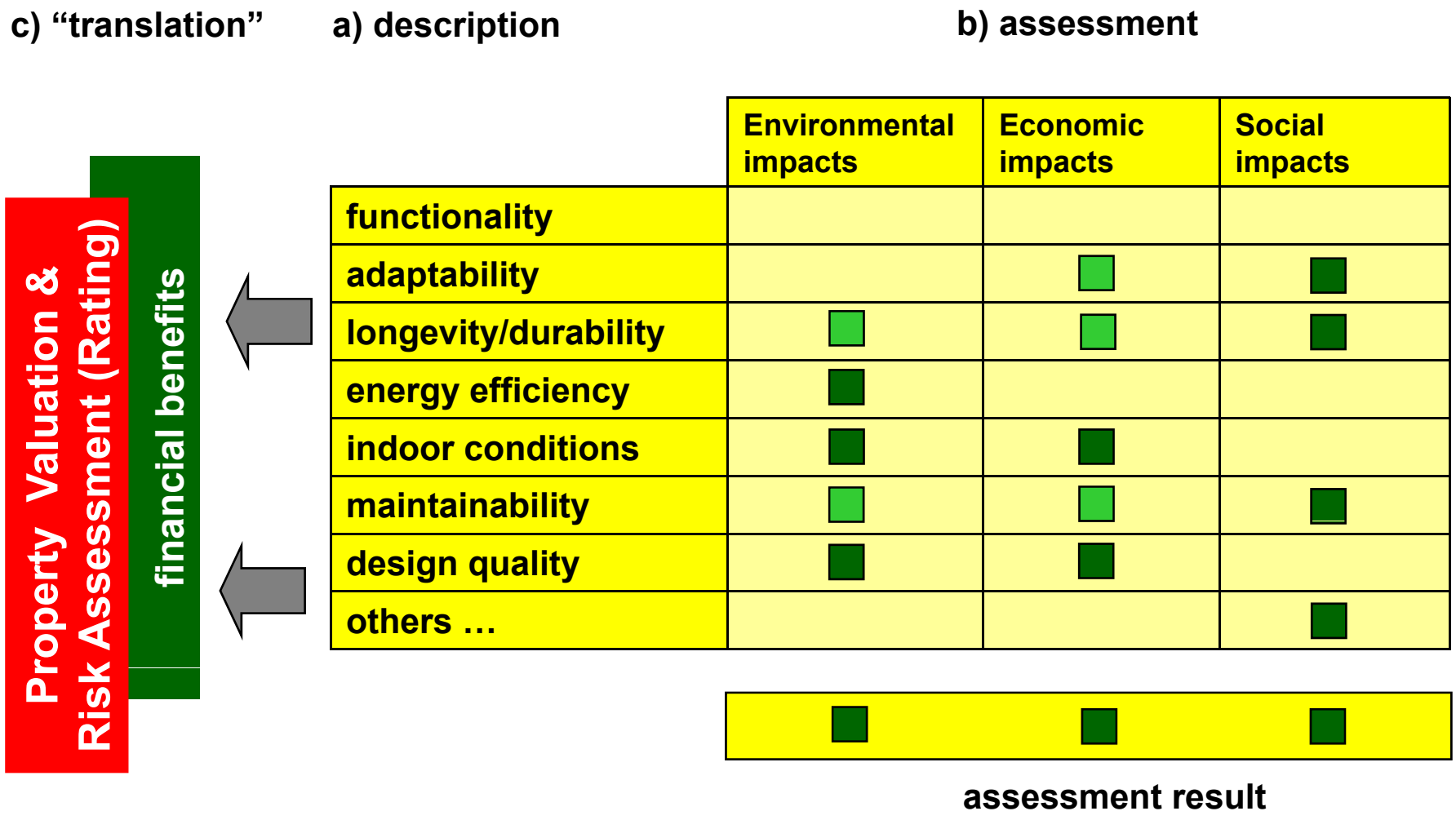
Source: Lützkendorf, 2007

From triple bottom line approach - to integrated performance



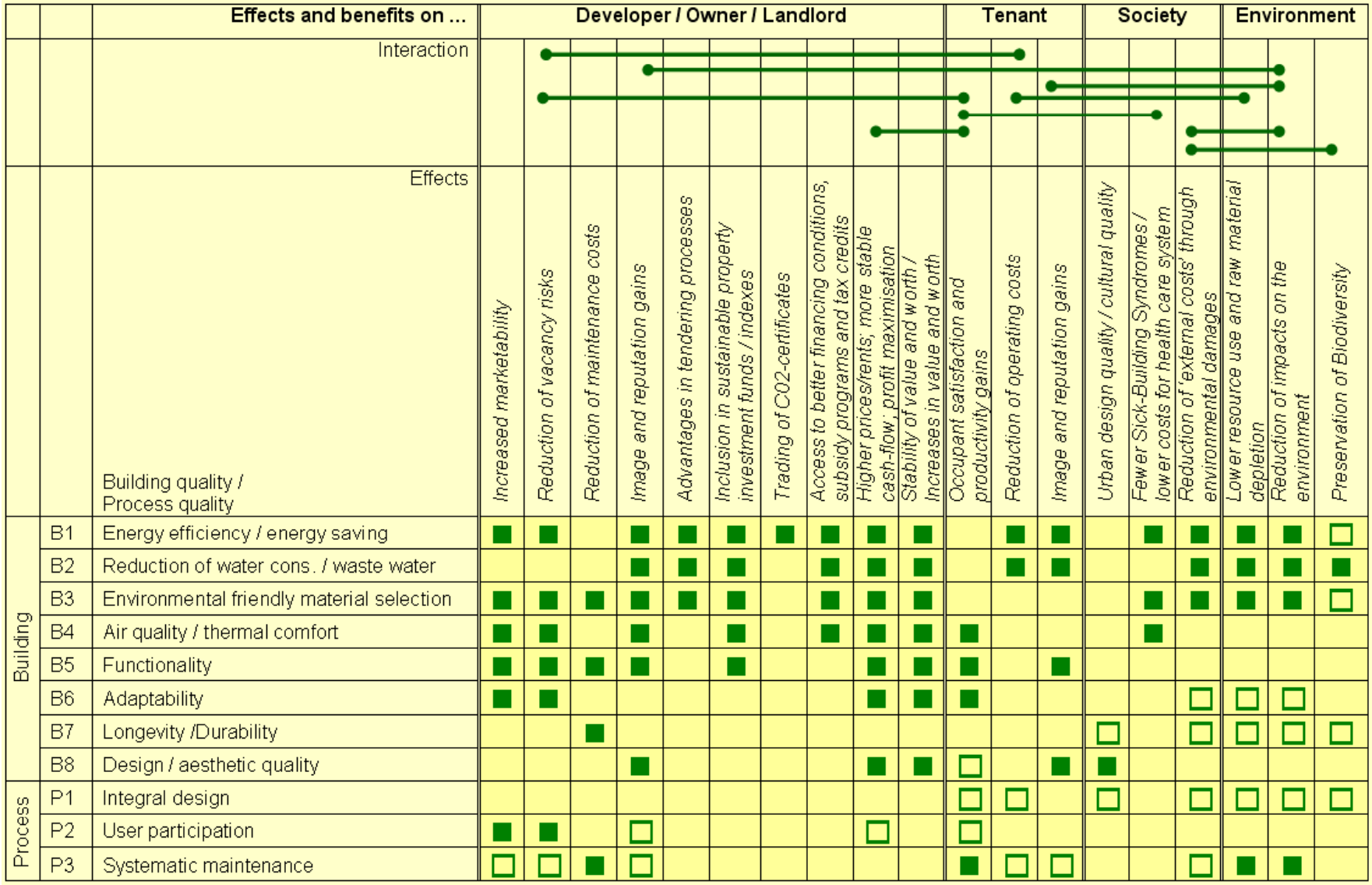
Source: Lützkendorf and Lorenz, 2006

How to translate "sustainability" to investors?



Source: Lützkendorf, 2007

Effects and benefits of sustainable buildings I



		Effects and benefits on ...	Developer / Owner / Landlord										Tenant			Society			Environment		
		Interaction																			
		Effects	*Increased marketability*	*Reduction of vacancy risks*	*Reduction of maintenance costs*	*Image and reputation gains*	*Advantages in tendering processes*	*Inclusion in sustainable property investment funds / indexes*	*Trading of CO2-certificates*	*Access to better financing conditions, subsidy programs and tax credits*	*Higher prices/rents; more stable cash-flow; profit maximisation*	*Stability of value and worth / Increases in value and worth*	*Occupant satisfaction and productivity gains*	*Reduction of operating costs*	*Image and reputation gains*	*Urban design quality / cultural quality*	*Fewer Sick-Building Syndromes / lower costs for health care system*	*Reduction of 'external costs' through environmental damages*	*Lower resource use and raw material depletion*	*Reduction of impacts on the environment*	*Preservation of Biodiversity*
		Building quality / Process quality																			
Building	B1	Energy efficiency / energy saving	■	■		■	■	■	■	■	■	■		■	■		■	■	■	■	□
	B2	Reduction of water cons. / waste water				■	■	■		■	■	■		■	■			■	■	■	■
	B3	Environmental friendly material selection	■	■	■	■	■	■		■	■	■					■	■	■	■	□
	B4	Air quality / thermal comfort	■	■		■		■		■	■	■	■				■				
	B5	Functionality	■	■	■	■		■			■	■	■		■						
	B6	Adaptability	■	■							■	■	■					□	□	□	
	B7	Longevity /Durability			■											□		□	□	□	□
	B8	Design / aesthetic quality				■					■	■	□		■	■					
Process	P1	Integral design											□	□		□		□	□	□	□
	P2	User participation	■	■		□					□		□								
	P3	Systematic maintenance	□	□	■	□							■	□	□			□	■	■	

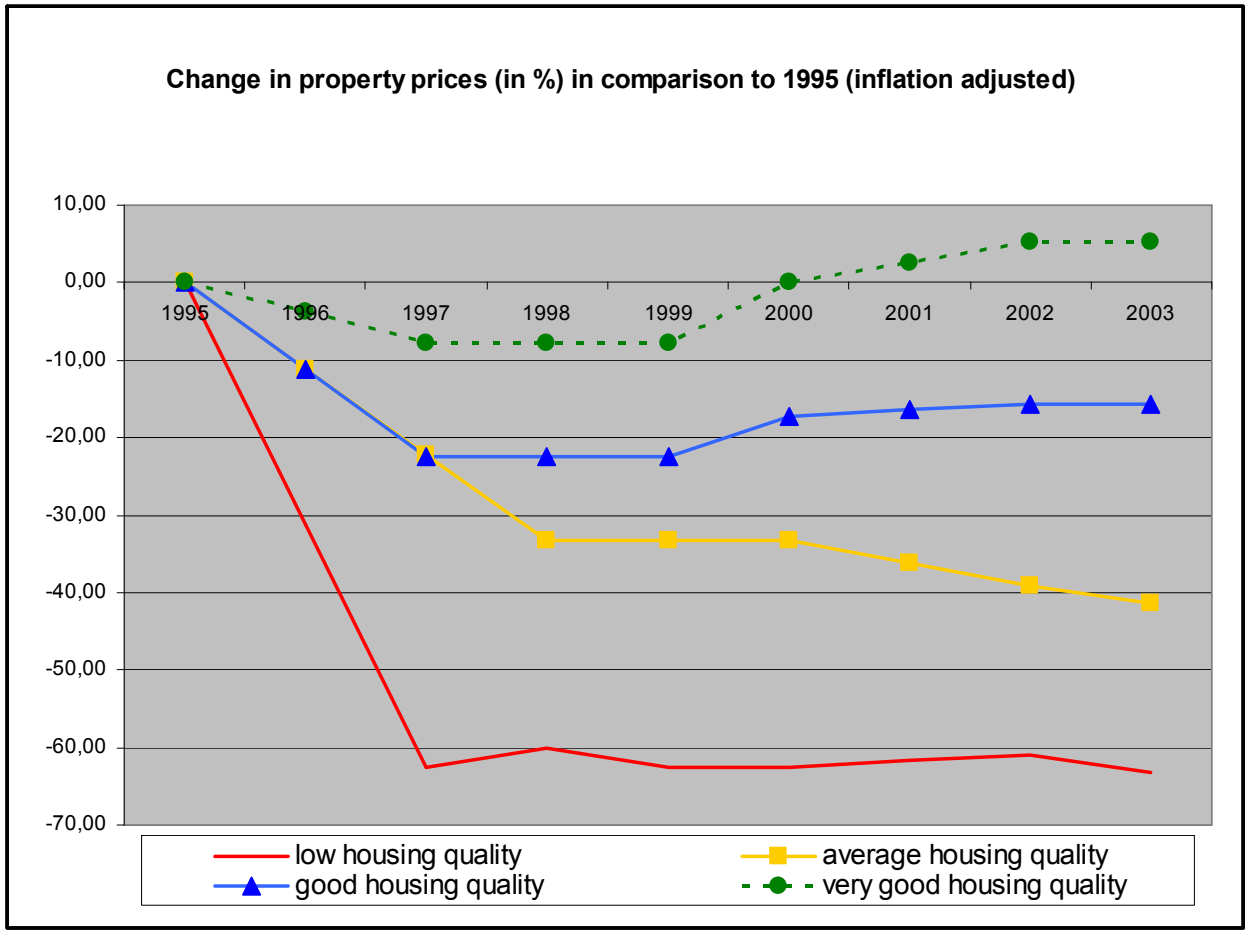
Source: Lützkendorf and Lorenz, 2007

Effects and benefits of sustainable buildings II

Characteristics and attributes of sustainable buildings	Examples for reductions in / avoidance of property specific risks
Flexibility and adaptability	*Reduction of risks through changes in market participants' preferences (obsolescence) and through restricted usability by third parties*
Energy efficiency and savings in water usage	*Reduction of risks through changes in energy and water prices; reduced business interruption risks (e.g. caused by power outages) through facilities that derive energy from on-site resources and/or have energy efficiency features*
Use of environmentally friendly and healthy building products and materials	*Reduction of litigation risks and of being held liable for paying compensations to construction workers and building occupants*
High functionality in connection with comfort and health of user and occupants	*Reduction of vacancy risks or of loosing the tenant(s)*
Construction quality, systematic maintenance and market acceptance	*Lower risks of changes in property values*
Compliance with / over-compliance of legal requirements in the areas of environmental- and health-protection	*Reduction of risks from increasingly stringent legislation (e.g. expensive retrofitting or losses in property values)*

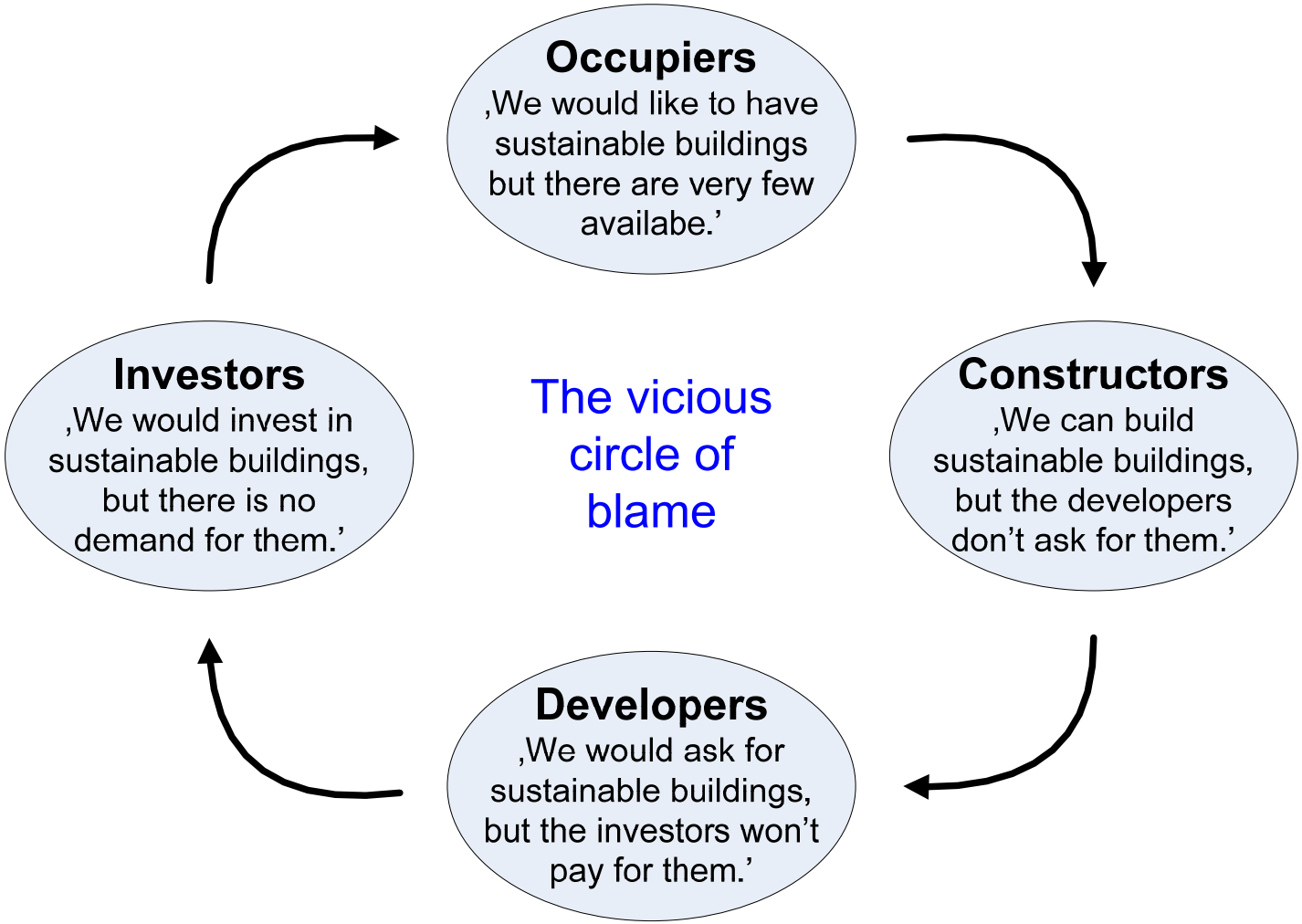
Building quality does pay! In particular under adverse market conditions

Property price development in Chemnitz (1995 – 2003), Residential housing unit including lot and garage



Source: Lorenz and Lützkendorf, *The impact of demographic developments on price trends and valuation practice of housing units in Germany*, 2005

The vicious circle of blame



Source: Cadman, D., 2000

The missing link

Investors

Developers, Planners & Constructors

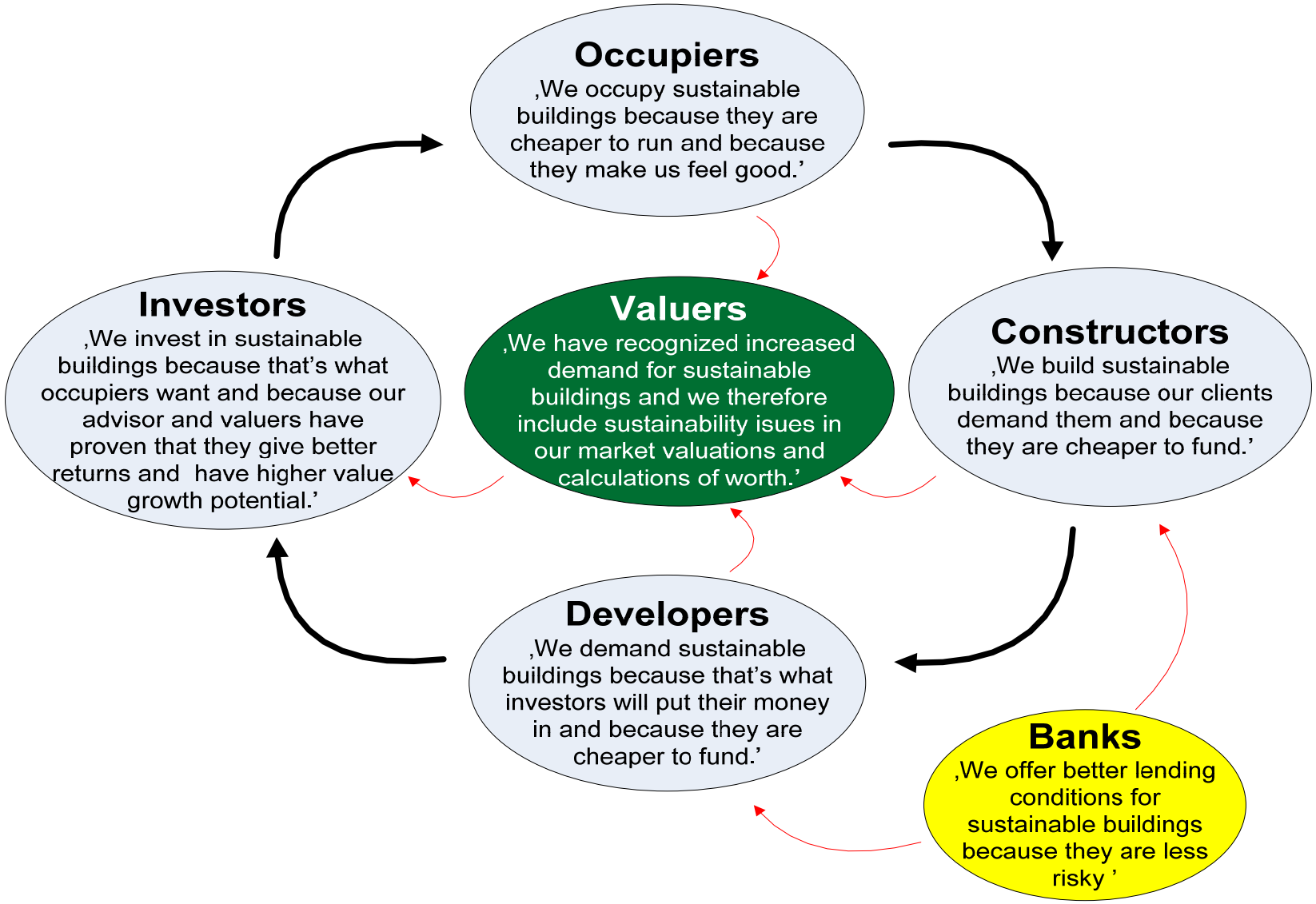
Property valuation professionals

Banks & Financial Institutions

Insurance Companies

„We recognize that there is market demand and preference for sustainable buildings but we do not have appropriate data and guidance to link sustianability issue to our estimates of cash-flow and market value“

Bursting the vicious circle of blame



Basic options for valuers to reflect sustainability issues

Traditional valuation methods	Advanced valuation / data analysis methods
Sales comparison method *Investment method / DCF-Analysis* *Cost method* *Profits method* *Residual method*	*Hedonic pricing methods* *Artificial neural networks* *Spatial analysis methods* *Fuzzy logic* *Autoregressive integrated moving average* *(Real options method)* *Rough set method*

Adjustment of valuation input parameters on the basis of personal experience and expert opinion

Transaction analyses to understand the relationships between sustainability related building characteristics and property prices

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Adjustment of valuation input parameters on the basis of personal experience and expert opinion

~~Transaction analyses to understand the relationships between sustainability related building characteristics and property prices~~

Currently impossible due to data limitations & deficits in the description of property assets

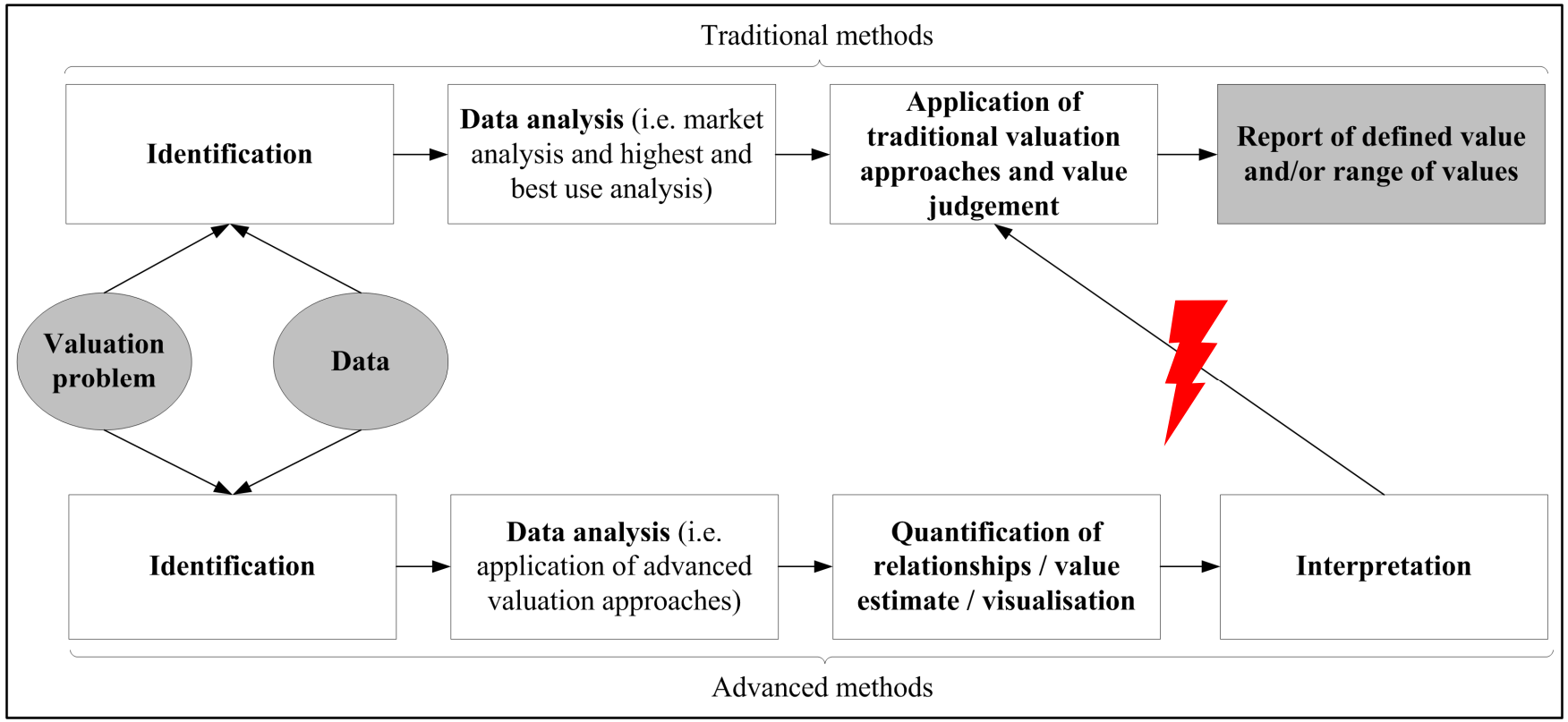
Key issue: Improvement of building descriptions

	Type	Brief Explanation	Examples
1	Characteristics based description	Statement on the availability, number, age or size of particular building features or components	Pool, central heating, green roof, number of rooms, flexible walls, suspended ceiling, etc.
2	Experience based description	Subjective and mainly qualitative judgement mainly based on implicit assumptions	Building quality is considered 'good' because of sound structural condition, favourable layout, equipment, etc.
3	Attribute based description	Judgement or classification based on quantifiable technical and/or physical building characteristics	Heat and sound insulation class, degree of efficiency of heating system, share of renewable materials, etc.
4	Performance based description	Measurement of direct impacts that result from the building's technical and physical characteristics	Primary energy demand, CO_2-emissions, life-cycle-costs, annual maintenance costs, etc.

Source: Lützkendorf and Lorenz, 2006

LCC (life-cycle costing) and LCA (life-cycle assessment) have to be used to improve the data quality to allow for an analysis of the relationship between building performance on the one hand and property prices and property specific risks on the other hand.

The valuation process



Source: Lorenz, 2006

Lack of empirical validation requires valuers explicitly explaining their **expert opinion** on both the benefits of sustainable design and on why and how these benefits impact on property values!

Suitability of different valuation methods – an overview

Valuation Method	*Suitability / Applicability*	*Critical valuation input parameters*	*Information sources*
Sales comparison method	√	net adjustments (either in € or in a percentage figure) for each comparable	Building descriptions, Building files, energy certificates & personal judgment
Investment method / DCF (for estimating Market Value)	√	capitalisation / discount rate, market rent, rent projections, operating / maintenance costs	Assessment tools (LCC); building files; rental indexes; Market analysis (wider market environment)
DCF (for calculating worth)	√	rental growth estimate, depreciation, risk premium and cash-flow estimate	Personal judgement, market analyses & investor's interests, expectations and risk preferences
Cost method	(√)	net adjustments (either in € or in a percentage figure) for obsolescence and depreciation	Personal judgment Tables for construction costs of specific (green) elements

Investment method: Sustainability linking through to market value

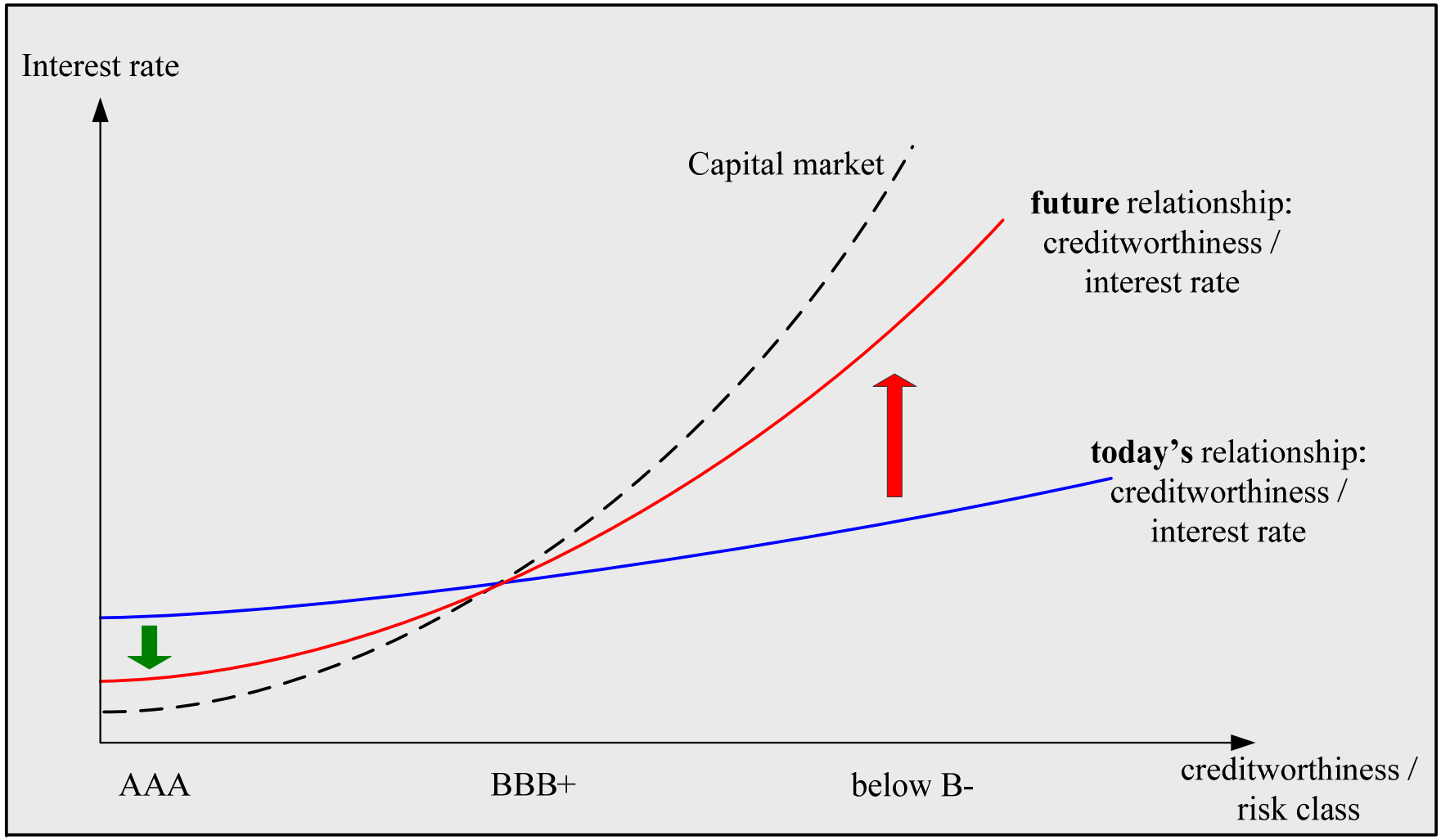
Sustainable design features	Benefits	Impacts on
Flexibility and adaptability	*Reduction of risks through changes in market participants' preferences (obsolescence) and through restricted usability by third parties; i.e. longer useful economic life and more stable cash flow*	***Capitalisation / discount rate; rent projection in DCF-analyses***
Energy efficiency and savings in water usage	*Reduction of risks through changes in energy and water prices; improved marketability; reduced business interruption risks through facilities that derive energy from on-site resources and/or have energy efficiency features*	***Operating costs; capitalisation/ discount rate; rent projection in DCF-analyses***
Use of environmentally friendly and healthy building products and materials	*Improved marketability; reduction of litigation risks and of being held liable for paying compensations to construction workers and building occupants*	***Capitalisation / discount rate***
High functionality in connection with comfort and health of user and occupants	*Reduction of vacancy risks or of loosing the tenant(s); improved marketability*	***Capitalisation / discount rate; market rent***
Construction quality; Ease of conducting maintenance, servicing and recycling activities	*Lower repair and maintenance costs; improved marketability*	***Operating costs; market rent***
Compliance with / over-compliance of legal requirements	*Reduction of risks from increasingly stringent legislation (e.g. expensive retrofitting)*	***Capitalisation / discount rate***
Reduced impacts on the local and global environment	*Image and reputation gains for owners and users*	***Capitalisation / discount rate***

Investment Method: Example – Composition & Calculation of ARY

Composition and calculation of the All Risks Yield		Maximum Risk Score	Maximum Risk Premium	Assigned Risk Score	Risk Premium	Calculation
Risk Free Rate						**3,50%**
Risk Premia for:						
Market (national and regional)		10	2,00%	5,0	1,00%	1,00%
Location		10	2,50%	5,0	1,25%	1,25%
Property						
	Architecture / Type of construction	10	0,25%	5,2	0,13%	0,13%
	Fitout	10	0,20%	4,5	0,09%	0,09%
	Structural condition	10	0,35%	5,5	0,19%	0,19%
	Plot situation	10	0,25%	5,0	0,13%	0,13%
	Ecological sustainability	10	0,50%	7,1	0,35%	0,35%
	Profitability of the building concept	10	0,25%	4,9	0,12%	0,12%
Quality of the property cash flow						
	Tenant and occupier situation	10	0,50%	5,5	0,28%	0,28%
	Rental growth potential / Value growth potential	10	0,30%	3,5	0,11%	0,11%
	Letting prospects	10	0,25%	5,0	0,13%	0,13%
	Vacancy / Letting situation	10	0,25%	1,0	0,03%	0,03%
	Recoverable and non-recoverable operating expenses	10	0,20%	3,0	0,06%	0,06%
	Usability by third parties and/or alternative use	10	0,20%	2,0	0,04%	0,04%
Exceptional circumstances		10	1,00%	0,0	0,00%	0,00%
			9,00%		**3,90%**	
All Risks Yield						**7,40**

A clear explanation of the composition and calculation of the applied discount / capitalization rate enhances the credibility of the valuation report and allows valuers to explicitly show the extent of accounting for sustainability issues!

Consequence of new banking capital adequacy rules (Basel II)



Improved financing conditions for sustainable buildings ?!

What is property rating?

Rating = procedure to illustrate the assessment of a thing, a person or situation, etc. on a scale

Property rating = application of standard credit rating techniques to individual property assets.

It aims displaying the quality of a property in its relevant market. The judgment refers to the medium-term sales prospects of the property.

Major fields of application:

- Risk analysis of property portfolios (e.g. in connection with securitisation)
- Property risk analysis in connection with investment and disinvestment decisions

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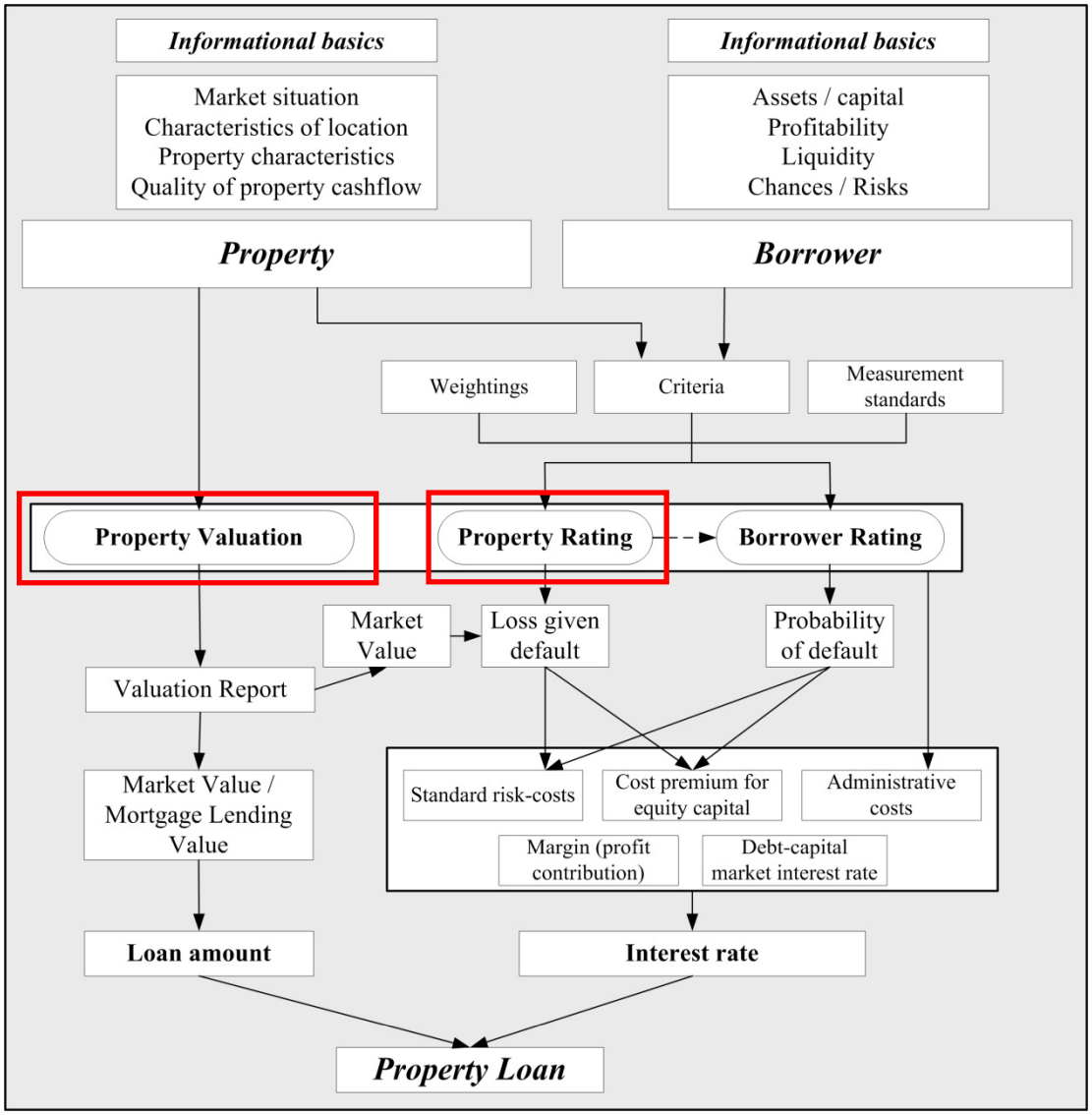
- Property risk analysis in the forefront of granting property loans
- Calculation of capital adequacy requirements as an element of banks' internal calculation of interest rates (**Basel II**)

Determination of financing conditions under Basel II (IRB-approach)



Source: Lützkendorf and Lorenz, 2006

Example: TEGoVa - European Group of Valuers‘ Association

Rating Results Criteria Class 'Property'

Rating Scale	Excellent	Very good	Good	Slightly above Ø	Ø	Slightly below Ø	Mediocre	Poor	Very poor	Disastrous	
Criteria Classes	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Weighting**
Architecture / type of construction					5,2						20,0%
Fitout					4,5						10,0%
Structural condition						5,8					15,0%
Plot situation					5,0						25,0%
Ecological sustainability						6,1					10,0%
Profitability of the building concept					4,8						20,0%
Result					**5,2**						100,0%

The European Group of Valuers' Association, an organization closely affiliated to the European mortgage industry and concerned with the development and harmonization of property valuation standards and with the education of valuation professionals.

TEGoVA represents 42 professional real estate bodies from 26 countries including: Albania, Austria, Bulgaria, Czech Republic, Denmark, Estonia, France, Germany, Greece, Hungary, Ireland, Italy, Kazakhstan, Latvia, Lithuania, Netherlands, Norway, Poland, Romania, Russian Federation, Spain, Sweden, Switzerland, Turkey, United Kingdom and the United States

The contribution of the German Association of Public Banks

Property and Market Rating for office buildings			Weightings		
			2. Level	3. Level	4. Level
Criteria Class 3 'Property'			**20,0%**		
3.1	**Architecture / Type of construction**		20,0%		
	3.1.1	Design Quality *		25,0%	
	3.1.2	Illumination / Shading *		15,0%	
	3.1.3	Quality of the layout / Functionality *		60,0%	
3.2	**Fitout**		10,0%		
	3.2.1	Quality of the building's technical and security equipment *		25,0%	
	3.2.2	Quality of information and communication technology *		25,0%	
	3.2.3	Internal fixtures and fittings *		35,0%	
	3.2.4	Social facilities *		15,0%	
3.3	**Structural condition**		15,0%		
	3.3.1	Age / year of construction / construction era *		20,0%	
	3.3.2	Degree of modernisation / Revitalisation *		40,0%	
	3.3.3	Maintenance situation / Maintenance backlog *		40,0%	
3.4	**Plot situation**		25,0%		
	3.4.1	Plot layout / Topography *		25,0%	
	3.4.2	Geological condition and archaeological aspects *		20,0%	
	3.4.3	Contaminations *		20,0%	
	3.4.4	Internal and external accessibility / infrastructure *		20,0%	
	3.4.5	Appurtenant structures / External facilities *		15,0%	
3.5	**Ecological sustainability**		10,0%		
	3.5.1	Building materials *		40,0%	
	3.5.2	Energetic performance / energy demand / energy consumption *		35,0%	
	3.5.3	Emissions *		25,0%	
3.6	**Profitability of the building concept**		20,0%		
	3.6.1	Space efficiency (rentable floor area / gross floor space) *		30,0%	
	3.6.2	Operating costs (in € per m² of gross floor space) *		50,0%	
	3.6.3	Public burdens (planning regulations, fire safety requirements, historical interest, etc.) *		20,0%	
Criteria Class 4 'Quality of the property cash flow'			**30,0%**		
4.1	**Tenant and occupier situation**		20,0%		
	4.1.1	Number of tenants, tenants' solvency and image, appropriate mix of tenants *		60,0%	
	4.1.2	Duration and structure of rental contracts *		40,0%	
4.2	**Rental growth potential / Value growth potential**		30,0%		
	4.2.1	Rental growth potential *		50,0%	
	4.2.2	Value growth potential (estimated change of re-selling price) *		50,0%	
4.3	**Letting prospects**		20,0%		
4.4	**Vacancy / Letting situation**		10,0%		
4.5	**Recoverable and non-recoverable operating expenses**		10,0%		
	4.5.1	Level of operating costs *		65,0%	
	4.5.2	Possibility of attributing management and operating costs to the tenants *		35,0%	
4.6	**Usability by third parties and/or alternative use**		10,0%		

*TEGoVA's rating criteria, further specified by the German Association of Public Banks (VÖB). The rating criteria introduced by the German Association of Public Banks are marked with **

direct links to sustainability issues

indirect links to sustainability issues

First Test-Rating Results: „greener“ buildings = less risks!!

Multiple-Family Dwelling	Rating Scores									
	1	2	3	4	5	6	7	8	9	10
	Excellent	Very good	Good	Slightly above Ø	Ø	Slightly below Ø	Mediocre	Poor	Very Poor	Disastrous
Very good property market conditions										
Superior building (in terms of sustainability)			2.9							
Average building (in terms of sustainability)				3.6						
Poor building (in terms of sustainability)					5.3					
Average property market conditions										
Superior building (in terms of sustainability)			3.4							
Average building (in terms of sustainability)				4.2						
Poor building (in terms of sustainability)						5.9				
Poor property market conditions										
Superior building (in terms of sustainability)				4.3						
Average building (in terms of sustainability)					5.0					
Poor building (in terms of sustainability)							6.7			

Source: Lützkendorf and Lorenz, 2007

Improved chances and/or reduced risks of sustainable buildings can be expressed and communicated by making use of already existing property rating systems

But: sustainability related assessment criteria, indicators and measurement standards in existing rating systems are rather crude and have been developed completely independent from the development of LCA and LCC tools by the sustainable building community

Key issue: Improvement of building descriptions

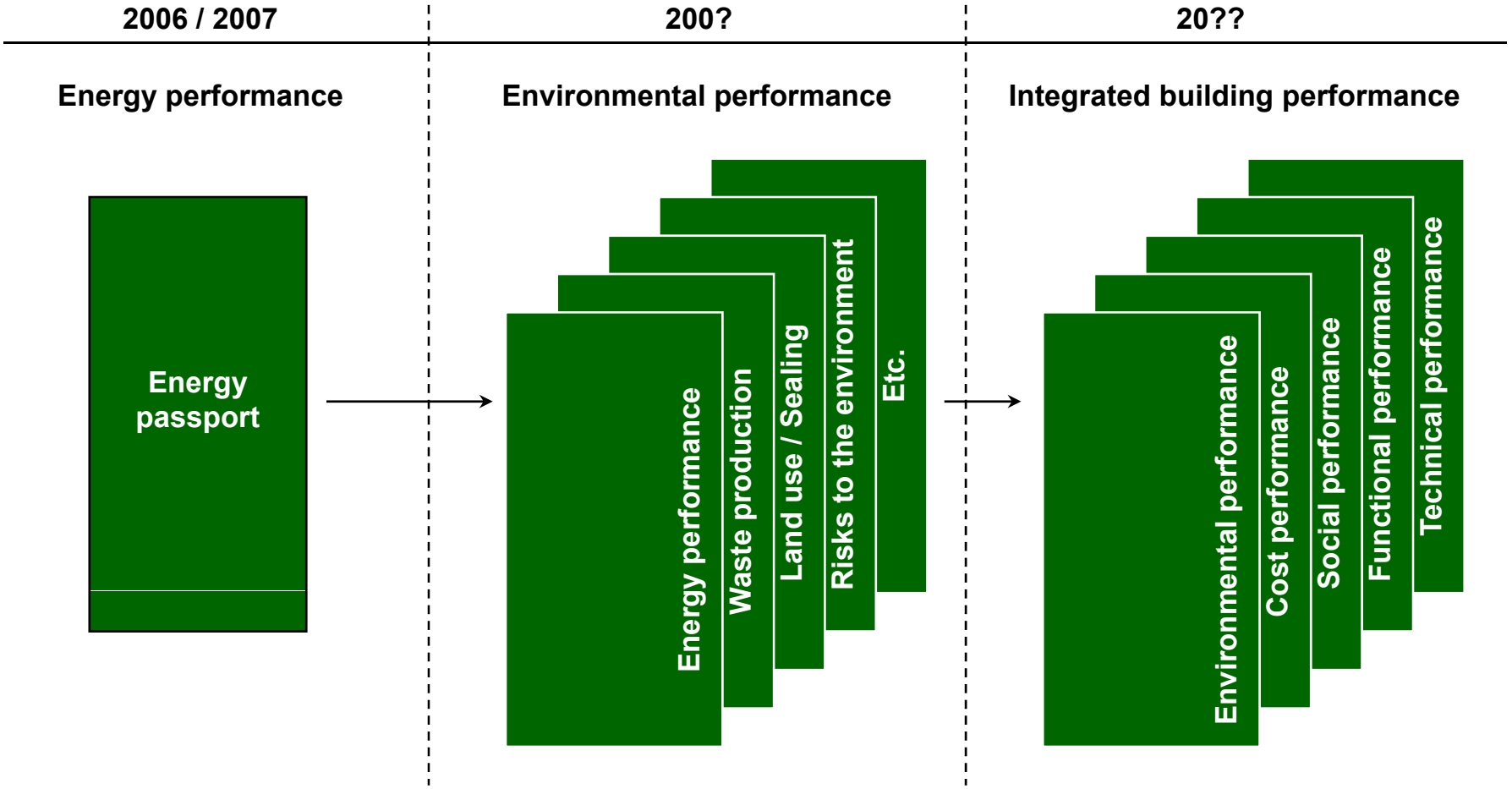
	Type	Brief Explanation	Examples
1	Characteristics based description	Statement on the availability, number, age or size of particular building features or components	Pool, central heating, green roof, number of rooms, flexible walls, suspended ceiling, etc.
2	Experience based description	Subjective and mainly qualitative judgement mainly based on implicit assumptions	Building quality is considered 'good' because of sound structural condition, favourable layout, equipment, etc.
3	Attribute based description	Judgement or classification based on quantifiable technical and/or physical building characteristics	Heat and sound insulation class, degree of efficiency of heating system, share of renewable materials, etc.
4	Performance based description	Measurement of direct impacts that result from the building's technical and physical characteristics	Primary energy demand, CO_2-emissions, life-cycle-costs, annual maintenance costs, etc.

Source: Lützkendorf and Lorenz, 2006

LCC (life-cycle costing) and LCA (life-cycle assessment) have to be used to improve the data quality to allow for an analysis of the relationship between building performance on the one hand and property prices and property specific risks on the other hand.

EU Thematic Strategy on the Urban Environment

EU Strategy: Widening the scope of energy performance certification into integrated building performance certification



Source: Lützkendorf and Lorenz, 2005

Conclusion

To foster market transformation the property industry's major decision support tools (rating and valuation) must be more closely linked to and underpinned by the results of existing life cycle assessment and life cycle costing methods.

Assessment methods, tools and assessment results

Integration into instruments and methods to support decision making	
Instruments	e.g. Property rating / Risk scoring systems
Methods	e.g. Property valuation

Market transformation	
Conditions	e.g. Interest rates & insurance rates
Products	e.g. Sustainable property investment funds / ‚green' REITs
Strategies	e.g. Socially responsible / sustainable property investment
Governmental measures	e.g. Subsidy programmes and tax schemes

Conclusion:

- The perception of property as a commodity is currently changing to emphasize sustainability-related building characteristics and performance aspects as important determinants of a property's worth and market value
- **But:** It will take years to accumulate the informational data basis necessary to empirically underpin a valuer's decision to provide a 'valuation bonus' for a sustainable building or a 'valuation reduction' for a conventional/unsustainable one

→ The validity of the valuer's judgment to account for sustainability issues when estimating market value or worth solely depends on the valuer's capability to explain and justify his or her assumptions within the valuation report.

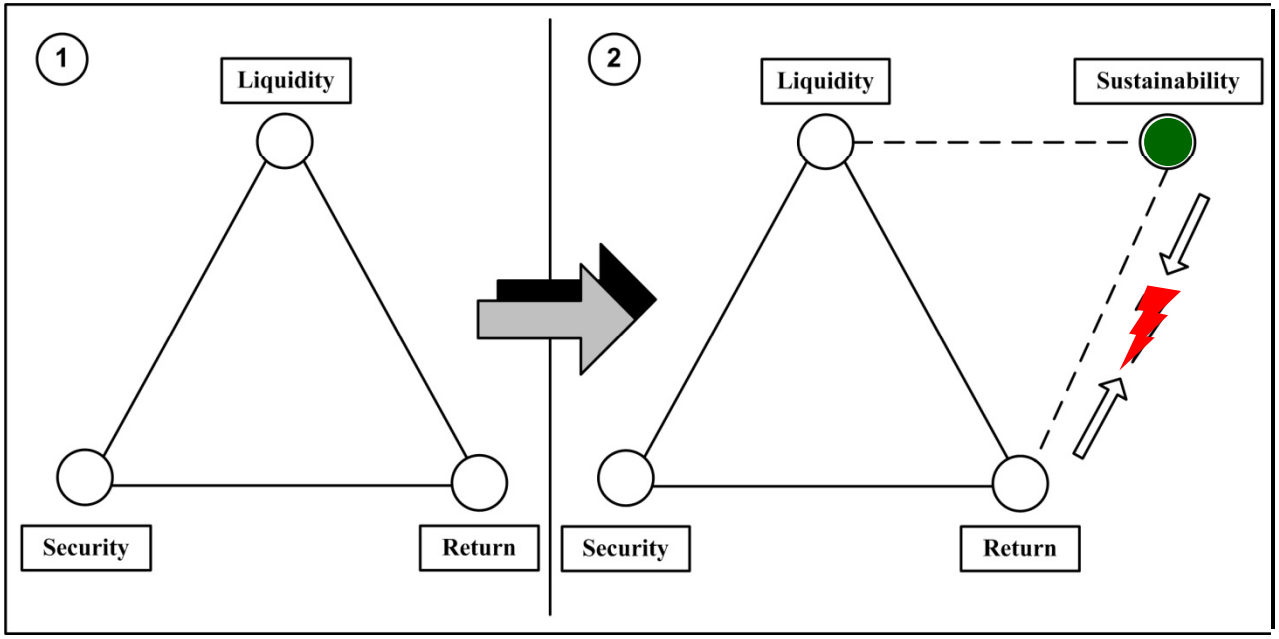
→ **Valuation reports should be extended to include the following additional elements:**

- A clear description of the availability of certain sustainability related property characteristics and attributes
- A statement of the valuer's opinion about the benefits of these characteristics and attributes and vice versa about the risks that accrue from their unavailability; and
- A statement of the valuer's opinion about the impact of these benefits and/or risks on property value.

Future research needs:

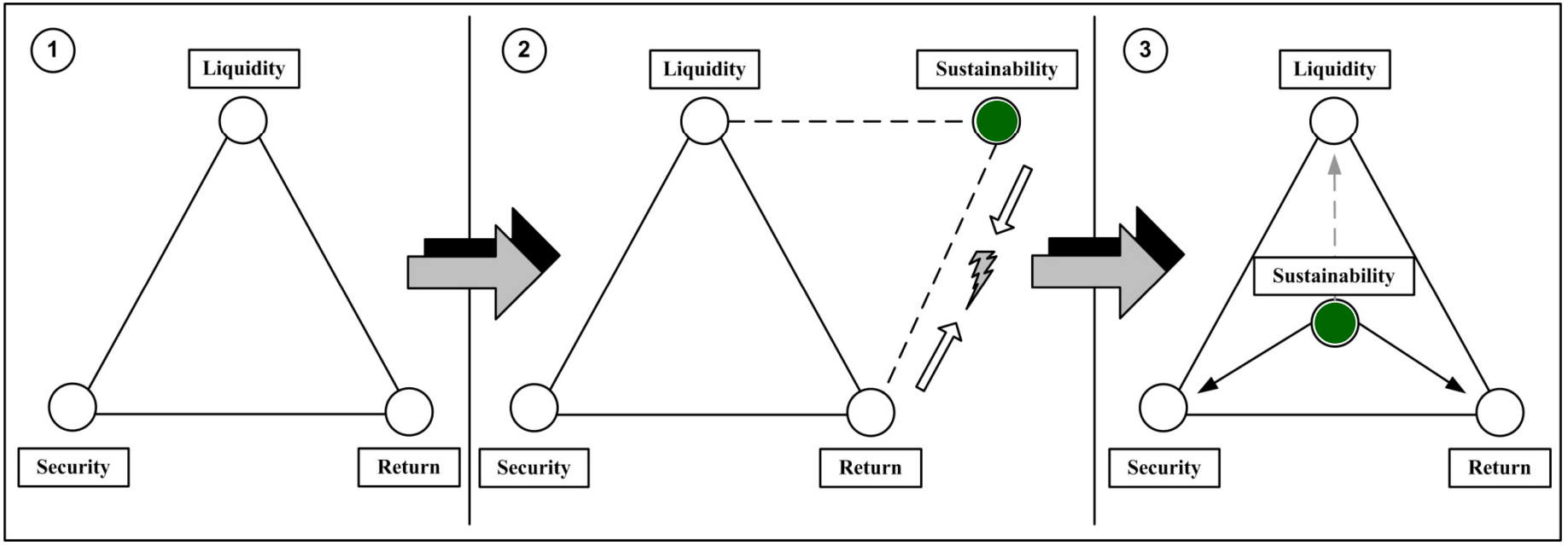
- Providing a more **robust informational basis** for analysing the relationships between sustainability-related building characteristics and property prices. This requires:
  - Improvement of the **description of property assets** by using clear criteria and performance indicators as well as reliable assessment methods and tools
  - The use of **building files/passports** for property information transfer
  - The creation of new and the extension of existing **property transaction databases and indexes**
- Demonstrating why and how **socially responsible property investments** enhance investment returns
- Providing more **guidance for valuers** on how to deal with and account for sustainability issues within valuation reports
- Raising **awareness among valuers** for their role, responsibility and possibilities in contributing to sustainable development within the property sector
- Inclusion of sustainability related elements into **education and training programs** for property professionals

Return or Sustainability ?



Return **or** Sustainability ?

Change the paradigm!



Source: Lützkendorf and Lorenz, 2005

Not Return **<u>or</u>** Sustainability but **Return and Security <u>through</u> Sustainability!**

Thank you very much for paying attention!

If you have any additional questions, please do not hesitate to contact me:

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Appendix

Sustainability Key Performance Indicators for Buildings (Lützkendorf and Lorenz, 2005)

Criteria	Indicators for the design stage	Indicators for the assessment of existing buildings
Object characteristics / Object performance		
Technical performance	Planned heat insulation class	Realised heat insulation class
	Planned sound insulation class	Realised sound insulation class
	Planned fire safety class	Realised fire safety class
	Planned load carrying capacity	Realised load carrying capacity
	Ease of conducting maintenance, servicing and recycling activities	Ease of conducting maintenance, servicing and recycling activities
Functional performance	Functionality and serviceability	Functionality and serviceability
	Adaptability and responsiveness	Adaptability and responsiveness
	Suitability for planned service life	Suitability for remaining service life
	Accessibility	Accessibility
Environmental performance		
Energy use	Primary energy demand during occupation (calculated)	Primary energy demand during occupation (measured)
Raw material depletion	Use of fossil fuels	Use of fossil fuels
	Use of mineral resources	
	Use of biotic / renewable resources	
Land use	Planned degree of sealing of the lot	Current degree of sealing of the lot
	Ecological value of the lot / change of ground quality	
	Planned land use per unit (e.g. number of workstations)	Current land use per unit (e.g. number of workstations)
Impacts on the environment	Global warming potential, GWP 100 (CO_2-equivalent)	Global warming potential, GWP 100 (CO_2-equivalent)
	Ozone depletion potential, ODP	Ozone depletion potential, ODP
	Acidification potential, AP (SO_2-equivalent)	Acidification potential, AP (SO_2-equivalent)
	Eutrophication potential, EP	Eutrophication potential, EP
	Photo-oxidant formation potential	Photo-oxidant formation potential
Waste production	Waste production during construction processes	Waste production during occupation and use
	Total waste accumulation (by categories)	Total waste accumulation (by categories)
Impacts on soil and ground water of lot	Material selection subject to separate checklist	Impacts on soil and ground water of lot
Economic performance		
Life cycle costs	Construction costs	Costs for refurbishment and modification
	Projected maintenance and operating costs	Effective maintenance and operating costs
	Projected disposal costs	Effective / projected disposal costs
Cash Flow		Income stream
Social performance		
Health of occupants / users		Appearance of Sick Building Syndrome / Building Related Illness
		Appearance of black mould
Comfort and well-being of occupants / users	e.g. thermal comfort measured as PPD / PMV	Occupant / user satisfaction measured through post occupancy evaluations
Safety of occupants / users		Number of building related accidents
Indoor air quality		Olfactory freshness
	Material selection subject to separate checklist	Concentration of selected substances (total volatile organic compound)
		Concentration of radon
Comfort and well-being of neighbours		Disturbance through building / use and occupation of building
Cultural value		Existing monumental protection

The Problem:

"In terms of some key environmental parameters, the Earth System has moved well outside the range of the natural variability exhibited over the last half million years at least. The nature of changes now occurring simultaneously in the Earth System, their magnitudes and rates of change are unprecedented. The Earth is currently operating in a no-analogue state."
(Amsterdam Declaration on Global Change, 2001)

"Human activity is putting such strain on the natural functions of Earth that the ability of the planet's ecosystems to sustain future generations can no longer be taken for granted."
(Millennium Ecosystem Assessment, 2006)

Millennium Ecosystem Assessment 2006 – selected findings

Nearly two thirds of the services provided by nature to humankind are found to be in decline worldwide.

Significant areas of forest, cultivated land, dryland rangelands, and costal and marine systems are now degraded, and the degraded area continues to grow.

Since 1945 more land (such as forests, savanna and natural grassland) was converted to cropland than in the eighteen and nineteenth centuries combined, and now approximately one quarter of Earth's terrestrial surface has been transformed to cultivated systems.

Forests have effectively disappeared in 25 countries, and more 90% of the former forest cover has been lost in a further 29 countries.

The estimated total net decrease in global forest area is estimated at 9.4 million hectares per year.

The construction of dams and other structures along rivers has resulted in fragmentation of almost 40% of the large river systems in the world. Thus, several of the world's larges rivers (such as the Nile, the Yellow and the Colorado) no longer run all the way to the sea for all or part of the year.

Since about 1980, approximately 35% of mangroves have been lost, while 20% of the world's coral reefs have been destroyed.

Human activities now produce more biologically usable nitrogen than is produced by all natural processes combined.

At least one quarter of marine fish stocks are overharvested. Approximately 90% of the total weight of large predators of the ocean such as tuna, swordfish, and sharks has disappeared.

The observed rate of species extinction in modern times are up to 1000 times higher than the average 'natural' rate of Earth's long-term history. Only approximately 10 % of the species on Earth have yet been identified but it is estimated that some 12% of birds, 25% of mammals, and at least 32% of amphibians are threatened with extinction over the next century.

Up to a quarter of the water supplied to human communities is being used in larger quantities than local river systems can provide.

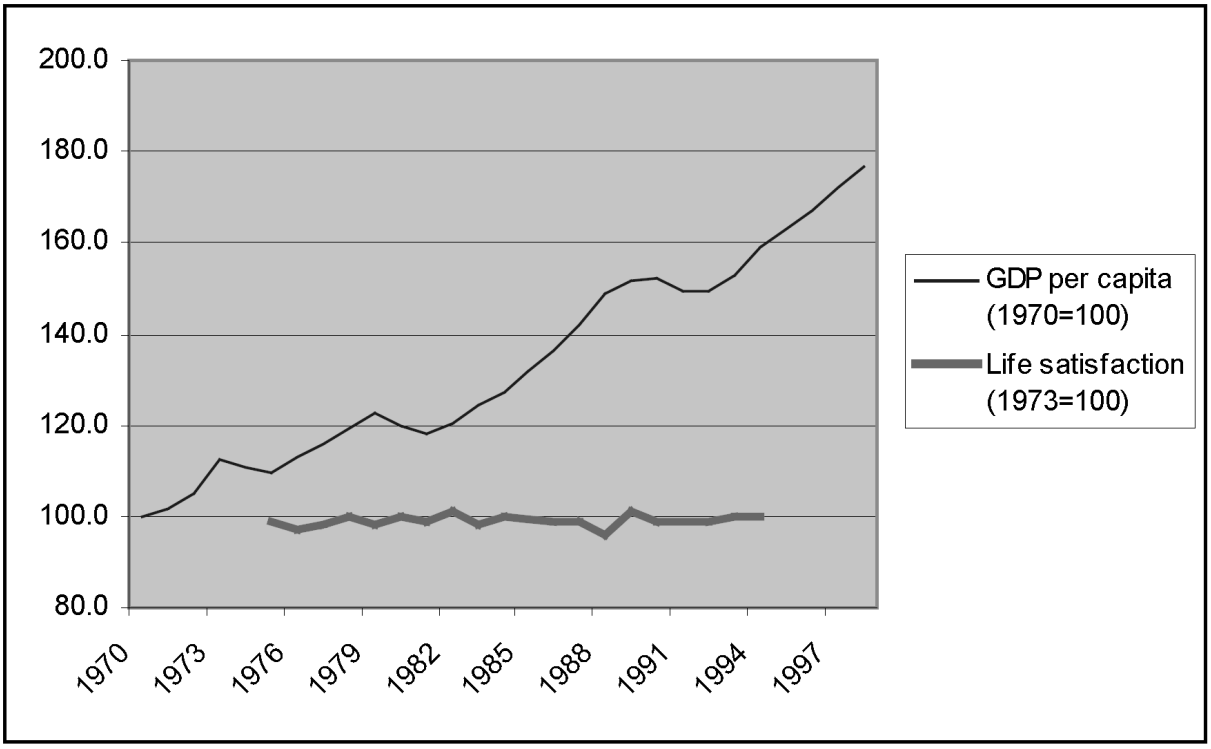
Inland water ecosystems are in worse condition overall than any other broad ecosystem type, and it is speculated that about half of all freshwater wetlands have been lost since 1900.

The global food production has doubled over the past 40 years but between 2000 and 2002 an estimated 852 million people were undernourished while this figure was at 37 million between 1997 and 1999.

The burden of disease from inadequate water, sanitation, and hygiene totals 1.7 million deaths and the loss of up to 54 million healthy lives year per year.

The Problem (cont.):

Life satisfaction in the UK and GDP per capita 1973-1997 (Donovan and Halpern, 2002)



'The collection of quotes presented here is meant to strengthen our motivation to make the world a success.'

Joseph Beuys *(artist, 1921-1986):*
'We have to create the world as a living sculpture. In the social body money should flow like a bloodstream. This method can only succeed if all people work together.'

'Quality will spring from this and will heal the damages and deformations of man and nature.'

Robert Filliou *(artist, 1926-1987):*
'Prostitution is the driving force of our economic system. We do not sell goods so much as we sell ourselves. We need an international network of people refusing the Economics of Prostitution, to further the ideas of Poetical Economy. The aim of Poetical Economy is to make people happy.'

Rupert Sheldrake *(biologist and author):*
'Obviously one ideal, which is already perfectly apparent to many people, is that the development of the earth should be sustainable. We should think not just three years ahead, or five years ahead, but a hundred or two hundred years ahead.'

Fritjof Capra *(physicist):*
'Are we talking about global partnership, global interdependence, or are we talking about global exploitation? Most economic policies and most business policies today, as we know, are more in the direction of global exploitation than global partnership. The model of the economy that we need has to be a systems approach. Economists, ecologists, scientists, psychologists, people in all these fields have to work together to deal with economics from a systematic point of view.'

'There needs to be a shift in values, together with a shift in thinking. A shift from fragmentation to wholeness, from quantity to quality, from growth to sustainability, from domination to partnership.'

David Bohm *(physicist, 1917-1992):*
'The first thing we have to do, is to look at our whole way of thinking. That means that people have to make a co-operative effort to have a dialogue, in which we will not merely exchange opinions, but actually listen deeply to the views of other people without resistance.'

'We have to understand each other even if we are different, then a coherent consciousness may arise which is capable of peace and the decrease of suffering over the whole world.'

'What we need is dialogues in the real sense of the word 'dialogue', which means 'flowing through'. The spirit of dialogue is not competition, but it means that everybody wins.'

Francisco Varela *(biologist and philosopher, 1946-2001):*
'You actually have a whole set of behavioural processes, genetic processes and ecological phenomena that can only be accounted for on the basis of co-operation. Behavioural processes on the basis of co-operation can be called love.'

J.C.J. Vanderheyden *(artist):*
'Human love is the only opposite of fear. There is no fear in a moment of love. Love is the energy for surviving.'