

PBL AND SUSTAINABILITY IN ENGINEERING AND SCIENCE EDUCATION AT AALBORG UNIVERSITY

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THE RESEARCH PROJECT

- An research project conducted by
- Kirsten Krogh Hansen, Mona Lisa Dahms, Kathrin Otreel-Cass and Aida Guerra
- See the final report
- Krogh Hansen, K., Dahms, M-L., Otreel-Cass, K., & Guerra, A. (2014). [Problem Based Learning and Sustainability: Practice and Potential](#). Faculty of Engineering and Science, Aalborg University.

COPERNICUS CHARTER/ECIU

- Commitment of AAU to support adoption and implementation of the COPERNICUS/ECIU guidelines for Sustainable Development in the European Higher Education Area
- How can the conception of sustainability be integrated?
- To what extent is this already the case?

AIMS OF STUDY/INVENTORY

Phase 1

- The way the concept of sustainability is integrated, interpreted and delimited in relation to the different educational programmes and contexts
- The role of PBL in designing and carrying out engineering and science activities that integrate key concepts of sustainability

Phase 2

- Identification and sharing of existing strategies for integrating sustainability in the educational programmes at both strategic and staff level
- Potential for further integration of sustainability in PBL and courses in engineering and science education.

PHASE 1 OUTCOME

Document
analysis
Interviews

DOCUMENT ANALYSIS

- Analysis of 104 programmes from TN-AAU, Aalborg, Esbjerg and Copenhagen

GLOBAL
REPORTING
INITIATIVE

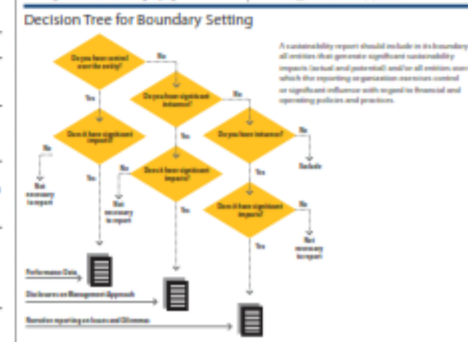
- Global Reporting Initiative: Sustainability Reporting Guidelines G3.1 – Reference Sheet
- <https://www.globalreporting.org/reporting/latest-guidelines/g3-1-guidelines/Pages/default.aspx>

Standard Disclosures: Performance

SUSTAINABLE HUMAN RIGHTS KEY	
Categories (6)	
ASPECTS	
001	Case Indicators are those indicators identified in the GRI Guidelines to be of interest to most stakeholders and assessed in the material areas assessed otherwise on the basis of the GRI Reporting Principles.
002	Additional Indicators are those indicators identified in the GRI Guidelines that represent significant issues or address topics that may be material to some organizations but not generally for a majority.
Environmental	
MATERIALS	
003	Material used by weight or volume
004	Percentage of materials used that are recycled input materials.
ENERGY	
005	Total energy consumption by primary energy source
006	Indirect energy consumption by primary source
007	Energy saved due to conservation and efficiency
008	Initiatives to promote energy efficient or sustainable energy related products and services, and reductions in energy requirements in one of the following categories:
009	Initiatives to reduce energy consumption and emissions achieved
WATER	
010	Total water withdrawn by source
011	Water source significantly affected by withdrawal of water
012	Percentage and total volume of water recycled and reused
WASTEWATER	
013	Location and size of land-based, liquid, managed or, as adjacent to, protected areas and areas of high biodiversity value outside protected areas
014	Discharges of significant inputs of activities, products, and services or land-based or liquid-based waste and areas of high biodiversity value outside protected areas
015	Activities generated or avoided
016	Waste type, volume, and time taken for managing inputs on land-based
017	Number of off-site land-based inputs and estimated contamination for inputs such as facilities in areas of high biodiversity or land-based or liquid-based waste and areas of high biodiversity value outside protected areas
ENVIRONMENTAL SPILLS AND WAHES	
018	Total direct and indirect greenhouse gas emissions by weight
019	Other relevant indirect greenhouse gas emissions by weight
020	Initiatives to reduce greenhouse gas emissions and emissions avoided
021	Percentage of water-discharging operations by weight
022	NO ₂ , SO ₂ and other significant air emissions by type and weight
023	Total water discharge by quality and destination
024	Total weight of water by type and disposal method
025	Percentage and volume of significant spills
026	Weight of significant inputs required or avoided waste avoided hazardous waste (on the basis of the Basel Convention Annex I, II, III, and IV) and weight of non-hazardous waste avoided
027	Heavy, toxic, protected, critical, and biodiversity value of water bodies and related habitats significantly affected by reporting organization's discharges of water and waste
PRODUCTS AND SERVICES	
028	Initiatives to mitigate environmental impacts of products and services, and extent of impact
029	Percentage of products sold and those packaging materials that are reclaimed by category
COMPLIANCE	
030	Monetary value of significant fines and total number of new monetary values for noncompliance with environmental laws and regulations
TRAINING	
031	Percentage of training hours of participating products and other goods and materials, used by the organization's operations, and participating members of the workforce
OVERALL	
032	Total number of significant positive impacts and non-compliance by type
Human Rights	
ENVIRONMENT AND PROCUREMENT PRACTICES	
033	Percentage and total number of significant material agreements and contracts that include human rights management system elements, or that have undergone human rights screening
034	Percentage of significant suppliers, contractors and other business partners that have undergone human rights screening, and actions taken
035	Total hours of employee training on policies and procedures addressing impacts of human rights that are relevant to procurement, including the percentage of employees in need
NON-DISCRIMINATION	
036	Total number of instances of discrimination and corrective actions taken
FREEDOM OF ASSOCIATION AND COLLECTIVE BARGAINING	
037	Operations and significant suppliers identified as having significant risk for incidents of forced or compulsory labor, and measures to contribute to the elimination of abuses of labor or compulsory labor
FORCED AND COMPULSORY LABOR	
038	Operations and significant suppliers identified as having significant risk for incidents of forced or compulsory labor, and measures to contribute to the elimination of abuses of labor or compulsory labor
SECURITY PRACTICES	
039	Percentage of security personnel trained in the organization's policies on protecting human rights and respect of human rights that are relevant to operations
INDIVIDUAL RIGHTS	
040	Total number of members of institutions meeting rights of indigenous people and actions taken
AGREEMENT	
041	Percentage and total number of agreements that have been subject to human rights screening and/or impact assessments
RECRUITMENT	
042	Number of personnel related to human rights filed, identified and resolved through formal grievance mechanisms
Labor Practices and Decent Work	
EMPLOYMENT	
043	Total workforce by employment type, employment contracts, and origin, based on direct employment
044	Total number and rate of new employees hired and employee turnover by age group, gender and region
045	Benefits provided for full-time employees that are not provided to temporary or part-time employees, by significant business units
046	Return to work and rehabilitation after permitted leave, by gender
LABOR/MANAGEMENT RELATIONS	
047	Percentage of employees union or by collective bargaining agreements
048	Minimum sector general or industry-specific standards, including whether it is formalized collective agreements
OCCUPATIONAL HEALTH AND SAFETY	
049	Percentage of total workforce reported in formal post-management - worker health and safety conditions that help measure and address occupational health and safety programs
050	Hours of safety, occupational disorders, lost days, and absences, and number of work-related incidents by region and by gender
051	Educations, training, counseling, government, and role-control programs in place to assist workers in safety, their families, or community members needing services during
052	Health and safety issues assessed in formalized assessments with trade unions
TRAINING AND EDUCATION	
053	Percentage hours of training per year per employee and by employee category
054	Programs for skills management and training, including training to enhance employability of employees and assist those managing career transitions
055	Percentage of employees in management performance and career development systems, by gender
DIVERSITY AND EQUAL OPPORTUNITY	
056	Composition of gender mix, ethnicity and breakdown of employees per employee category according to gender, age group, ethnicity, work membership, and other indicators of diversity
EQUAL OPPORTUNITY FOR WOMEN AND MEN	
057	Ratio of female staff and representation of women in key by employee category by significant locations of operation
Society	
LOCAL COMMUNITY	
058	Percentage of operations with impact-oriented local initiatives engaged in, impact assessments, and development programs that have undergone human rights screening and/or impact assessments

<p>EN01 Operations with significant potential to actual negative impacts on local communities.</p>	<p>EN02 Ministry value of significant losses to the environment with loss and regulations concerning the protection and use of products and services.</p>
<p>EN03 Personnel and significant measures in employment in operations with significant potential or actual negative impacts on local communities.</p>	<p>Economic</p>
<p>DISBURSEMENT</p>	<p>ECONOMIC PERFORMANCE</p>
<p>EN04 Processing and total number of business units and other risks related to operations.</p>	<p>EN01 Direct revenues, gross generated and distributed, including revenues, operating costs, employee compensation, donations and other community activities, voluntary savings, and payments to capital providers and governments.</p>
<p>EN05 Personnel of environmental management, anti-corruption policies and procedures.</p>	<p>EN02 Financial capabilities and other risks and opportunities for the organization's activities due to climate change.</p>
<p>EN06 Public policy positions and participation in public policy development and lobbying.</p>	<p>EN03 Coverage of the organization's defined benefit plan obligations.</p>
<p>EN07 Total number of significant risks and opportunities in operations, public policy, and related initiatives by country.</p>	<p>EN04 Significant financial resources received from government.</p>
<p>ANTI-CORRUPTION RISK</p>	<p>MARKET PRESENCE</p>
<p>EN08 Total number of legal actions for anti-corruption behavior, bribe, fraud, and money laundering and other activities.</p>	<p>EN05 Range of values of standard equity level range by gender category for the local community at the significant locations of operations.</p>
<p>COMPLIANCE</p>	<p>EN06 Policy positions, and proportion of spending on local level by sector at significant locations of operations.</p>
<p>EN09 Ministry value of significant fines and total number of non-material violations for non-compliance with laws and regulations.</p>	<p>EN07 Procedures for local funding and proportion of similar management based from the local community at locations of significant operations.</p>
<p>Product Responsibility</p>	<p>INDIRECT ECONOMIC IMPACTS</p>
<p>CUSTOMER HEALTH AND SAFETY</p>	<p>EN08 Development and impact of infrastructure investments, and services provided generally for public health through commercial, indirect, or private investments.</p>
<p>EN10 Life cycle stages in which health and safety impacts of products and services are assessed for improvement, and percentage of significant products and services categories subject to such procedures.</p>	<p>EN09 Understanding and disclosing significant indirect economic impacts, including the extent of impacts.</p>
<p>EN11 Submission of materials of non-compliance with regulations and voluntary codes concerning health and safety impacts of products and services during their life cycle, by type of national jurisdiction.</p>	<p>Guidance for using Indicators</p>
<p>PRODUCT AND SERVICE LABELING</p>	<p>Incorporating the Performance Indicators, the following guidance as data-compliance options:</p>
<p>EN12 Type of product and service information required for products, and percentage of significant products and services subject to such information requirements.</p>	<p>Regarding on Trade: Information should be provided on current reporting period(s), new goal and/or last two previous period(s), as well as future targets, where they have been established, for the short and medium term.</p>
<p>EN13 Total number of violations of non-compliance with regulations and voluntary codes concerning product and service information and labeling, by type of national jurisdiction.</p>	<p>On the Offsets: Where applicable, the Offsets that accompany the Indicators about reporting on the Indicators. There are three guidance on interpreting and comparing indicators:</p>
<p>EN14 Previous indicators, including, including, results of surveys using customer satisfaction.</p>	<p>Proportionality of Data: In some cases, ratios or normalized discrete units and appropriate metrics for data presentation. In other cases, standardized data are used, absolute data should also be provided.</p>
<p>EN15 Progress for adherence to laws, standards, and voluntary codes related to marketing communications, including advertising, promotion, and sponsorship.</p>	<p>Data Aggregation: Reporting organizations should determine the appropriate level of aggregation of activities. The additional guidance in the General Reporting Data section of the Guidelines.</p>
<p>EN16 Total number of incidents of non-compliance with regulations and voluntary codes concerning marketing communications, including advertising, promotion, and sponsorship by type of national jurisdiction.</p>	<p>Relevance: Reported data should be presented using generally accepted international metrics (e.g., kilograms, metric ton, and standardized using standard conversion factors). Where specific international standards exist (e.g., GHG emissions), these are typically specified in the Indicator Protocols.</p>
<p>MARKETING COMMUNICATIONS</p>	<p></p>
<p>CUSTOMER POLICY</p>	<p></p>
<p>EN17 Total number of violations of non-compliance with regulations and voluntary codes concerning marketing communications, including advertising, promotion, and sponsorship by type of national jurisdiction.</p>	<p></p>
<p>EN18 Progress for adherence to laws, standards, and voluntary codes related to marketing communications, including advertising, promotion, and sponsorship.</p>	<p></p>
<p>EN19 Total number of incidents of non-compliance with regulations and voluntary codes concerning marketing communications, including advertising, promotion, and sponsorship by type of national jurisdiction.</p>	<p></p>
<p>EN20 Progress for adherence to laws, standards, and voluntary codes related to marketing communications, including advertising, promotion, and sponsorship.</p>	<p></p>
<p>EN21 Total number of incidents of non-compliance with regulations and voluntary codes concerning marketing communications, including advertising, promotion, and sponsorship by type of national jurisdiction.</p>	<p></p>
<p>EN22 Progress for adherence to laws, standards, and voluntary codes related to marketing communications, including advertising, promotion, and sponsorship.</p>	<p></p>
<p>EN23 Total number of incidents of non-compliance with regulations and voluntary codes concerning marketing communications, including advertising, promotion, and sponsorship by type of national jurisdiction.</p>	<p></p>
<p>EN24 Progress for adherence to laws, standards, and voluntary codes related to marketing communications, including advertising, promotion, and sponsorship.</p>	<p></p>
<p>EN25 Total number of incidents of non-compliance with regulations and voluntary codes concerning marketing communications, including advertising, promotion, and sponsorship by type of national jurisdiction.</p>	<p></p>

Standard Disclosures: Management Approach



DOCUMENT ANALYSIS

- Competence profile of the program and the Overview of the program
 - Apparent extent of sustainability in curriculum?
- Quantitative search for key words and their context

Environmental	
Categories	In connection with...
Environment	
Materials	
Energy	
Water	
Biodiversity	
Emissions, effluents, and waste	

DOCUMENT ANALYSIS

Environmental (B.Sc. BEM – Urban, energy and environment planning)

Categories	In connection with...		
Environment	Planning		
	Assessment	Climate change	
	Consequences		
	Impact		
	Resources		
	Legislation		
Materials	Source material		
	Maps (product...?)		
	Cycles		
Energy	City & environment	Planning	
	Sustainable solutions		
	Renewable		
	Issues	solutions	
	Planning	Climate change	
	Water and biodiversity		
	Energy balance of earth	Atmosphere, weather systems and climate	
	Cycle		
	stakeholder analysis		

9

DOCUMENT ANALYSIS - FINDINGS

Faculty of Science and Engineering	Sustainability			Comment
	Environment	Social	Economy	
School of Engineering and Science	23/61	17/61	14/61	<p>The social and economic aspects of sustainability are not necessarily found in connection with environmental sustainability.</p> <p>Two programmes only have elements of economic, one programme only have social aspects of sustainability.</p> <p>Nine of 61 programmes cover all three aspects of sustainability</p>
School of Information and Communication Technology	1/29	5/29	2/29	<p>Three programmes only cover social aspects of sustainability.</p> <p>No programme does only have economy – it is in connection with social or social and environmental aspects.</p> <p>One of 29 programme covers all three aspects of sustainability.</p>
School of Architecture, Design and Planning	12/14	12/14	9/14	<p>Apart from two programmes all programmes cover minimum environmental and social aspects of sustainability.</p> <p>Two programmes cover no aspects of sustainability.</p> <p>Three programmes only cover environmental and social aspects of sustainability, but no economic aspects of it.</p> <p>Nine of the 14 programmes cover all three aspects of sustainability.</p>
Total	36/104	34/104	25/104	

Dean **Eskild Holm Nielsen**

- Vice-dean **Lars Døvling**

Head of SES **Henrik Brohus**

- Head of Civil Engineering **Christian Frier** and **Rasmus Lund Jensen** from Indoor Environment and Energy
- Head of Energy **Birgitte Bak Jensen**
- Head of Industry and Global Business Development **Jens Henrik Andreasen**
- Head of Chemistry, Environmental engineering and Biotechnology **Niels T. Eriksen**
- Head of Mathematics, Physics and Nanotechnology **Eva Maria Petersen**
- Head of Techno-anthropology **Tom Børsen**

Head of SICT **Uffe Bro Kjærulff**

- Head of Computer Science **Hans Hüttel** (stand in for Lone Leth Thomsen)
- Head of Electronics and Information Technology **Ove Andersen**
- Head of Media Technology **Claus B. Madsen** (Stand in for Rolf Nordahl)

Head of SADP **Michael Tophøj Sørensen**

- Head of Architecture and Design **Henrik Harder**
- Head of Planning and Geography **Martin Lehmann** (stand in for Claus Lassen)

INTERVIEW - FINDINGS

- Status quo:
- PBL
- Future perspectives:
- Relevance:
- Leadership:

INTERVIEW – FINDINGS: STATUS QUO

- The interviews show more sustainability than apparent in written curricula
- Sustainability is explicit in some projects, but also implicit in a lot of projects
 - Implicit – within e.g. Nanotechnology where the students/supervisors might not be aware that it is sustainability they are writing about
- There are existing resources (human capital, existing research)
- Sustainability in the title of programmes is problematic – it implies other programmes are not sustainable.
 - Instead it needs to be in the learning outcomes
- Background of heads of study boards is influencing programmes – to some extent

INTERVIEWS – FINDINGS: PBL

- PBL is a natural way of implementing sustainability
 - Due to the interdisciplinary of sustainability
 - Only one respondent was vague about this point in regards to PBL
- Even when the concept of sustainability was only implied most agreed that the nature of PBL supports teaching and learning about sustainability

INTERVIEWS – FINDINGS: FUTURE PERSPECTIVES

- The programmes that already have sustainability integrated have no current plans of doing more
 - They do follow regular updates of programmes
- Programmes with no trace of sustainability (in written curricula or in interviews with Heads) have no plans of including aspects of sustainability
 - Not because they are against it, but because they have not given sustainability any thought at all
- One respondent was updating the curricula at the time and was prompted through this investigation to add a couple of points with regards to sustainability

INTERVIEWS – FINDINGS: RELEVANCE

- Respondents are all agreeing on sustainability as relevant
 - Not all aspects of sustainability are relevant for all programmes, but some aspects can be included in all programmes
 - University as a whole should cover all aspects of sustainability
 - Not all graduates from TN-AAU should be generalists, there is also a need for specialists

Eco-economic

- Resource economy
- Energy efficiency
- Global energy issues
- Product and service labelling

Socio-environmental

- Health & safety
- Legislation and regulation
- Climate change
- Crisis management

Environmental

- Permit & license compliance
- Biodiversity management
- Emissions to air
- Water/chemical usage and discharges

Sustainability

An integrated approach to Environmental, Social and economic impact issues (both internal and external) leads to long term, sustainable profit growth

Economic

- Consistent, profitable growth
- Risk management
- Total shareholder return
- Market presence
- Indirect economic impacts

Social

- Respect for the individual
- Equal opportunities
- Diversity
- Outreach programmes
- Human rights
- Child/forced labour
- Corruption
- Public policy

Socio-economic

- Employment
- Training & development
- Local economies & enterprise

- Social & community
- Sponsorships
- Customer health and safety

INTERVIEWS – FINDINGS: LEADERSHIP

- Heads of Study Boards support initiatives from staff
- Very few are willing to "tell people what to do"
- Heads of Study Boards welcome top-down – including financial resources, in order to work bottom-up

CURRENT SUGGESTIONS FOR "IMPROVEMENT"

- There are existing resources (human capital, existing research)
 - Develop an information bank collecting knowledge from AAU and other places so people have a place to turn for knowledge regarding sustainability
- AAU as a role model – walking the talk: University should be on the forefront of technological development. Green solutions might not all be financially sustainable yet, but the University Campus is a place to show the world...
- When to implement/where to implement
 - Quick solution: first year, then it's over and done with and can be forgotten!
 - Or later on it will be a tool for reflection and will be part of a professional profile
- Sustainability needs to be made explicit/visible in study programmes