

REDUCING EARLY STAGE CLEANTECH FUNDING GAPS: AN EXPLORATION OF THE ROLE OF ENVIRONMENTAL PERFORMANCE INDICATORS

APPENDIX 1

Comprehensive list of EPIs

Indicator	Metric	Academia	Practice		Govt
			Investors	Businesses	
CO2 emissions (vol/red)	t	x	x	x	x
CO2 intensity	%	x	x	x	x
GHGs (6)	t	x	x	x	x
Environmental impact cost	£		x		x
Biodiversity species	no.		x	x	x
Environment saved/restored	m2		x		x
Environmental quality					x
carbon footprint		x		x	x
Life cycle energy per unit	KwH per time	x			
Energy efficiency	%	x	x	x	x
Energy use per unit/saved	KwH	x	x	x	x
Energy security					x
Water quality	%			x	
Fresh water consumption	Litres	x	x		
Renewable energy	%	x	x		x
Solid waste	Kg	x	x	x	x
Hazardous waste	Kg	x			
Level of clean technology	%	x	x	x	x
Energy consumption in recycling	KwH	x			
Carbon credits	£			x	
Total recycling per unit	Kg	x	x		
Level of recycled material	%	x	x	x	x
Recycle time	Hrs/days	x			
Recycling saving	energy/kg		x		
degree of circularity	%			x	
Reuse potential	%	x			
Longevity of material	time	x		x	
Area farmed sustainably	ha		x		
Eco labels and accreditations	y/n	x	x	x	

Table 1: Main indicators per actor (based on the literature review – see below – and review of all collected data)

Process of the Literature Review

Initially, we searched the Scopus database according to the keywords ‘low carbon’ “AND” (‘economy “OR” metrics’) to get an idea of the low-carbon (‘cleantech’) ecosystem and environmental impact measurement. As a next step, following Ahi & Searcy (Ahi and Searcy, 2015), and Veleva & Ellenbecker (Veleva and Ellenbecker, 2001), we included terms such as ‘performance “AND” (measure “OR” evaluation “OR” assessment “OR” indicator)’. After a test and an initial search round with these keywords, we also included environmental ‘*performance indicator’ and ‘*performance evaluation’ (Nightingale, 2009). In total, the search led us to review over 330 papers. We then screened these papers in two consecutive rounds and excluded for example papers which only developed highly sophisticated indicator systems for certain industries (non-Cleantech). This left 122 academic, practitioner and policy papers that provide a first overview of indicator usage in the Cleantech ecosystem.

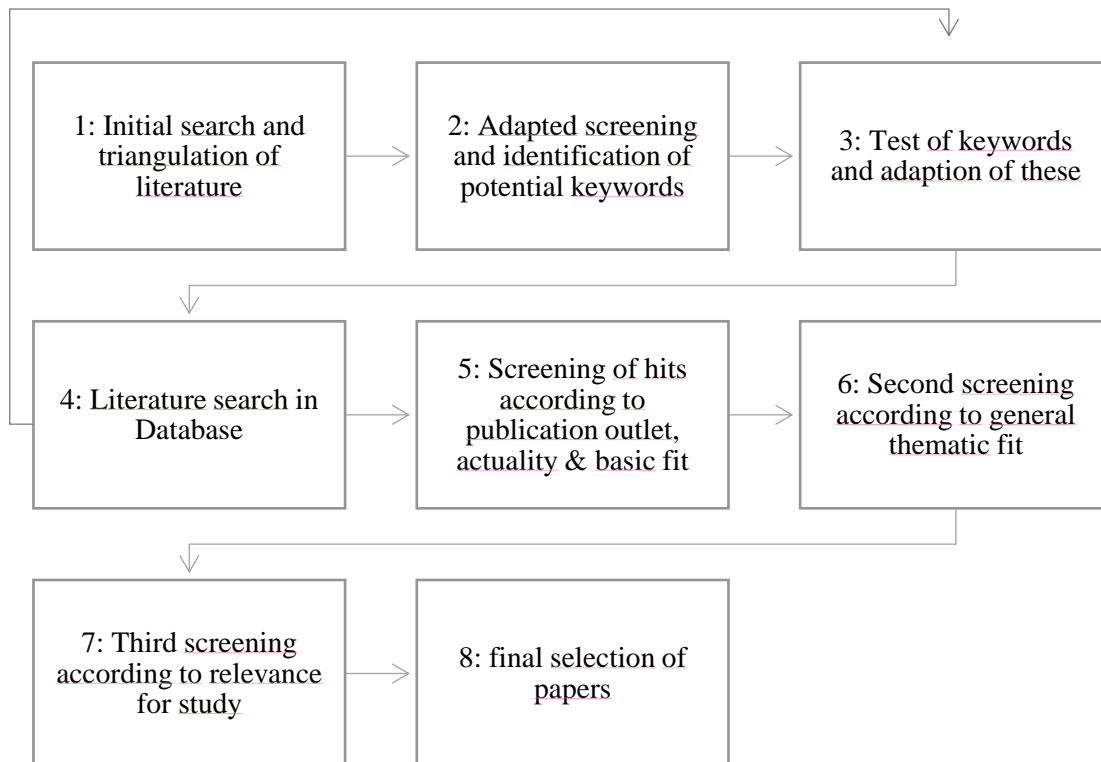


Figure 1: process of literature review according to Nightingale (2009) and Tranfield et al. (2003)

Results of the Literature Review

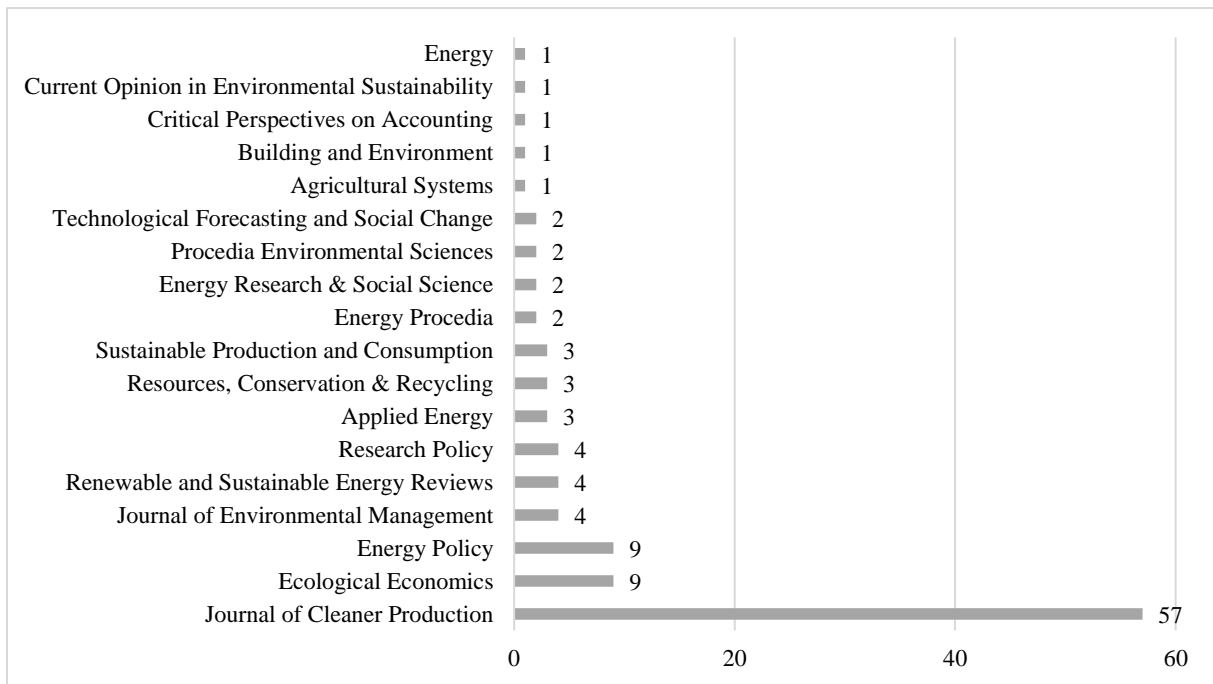


Table 2: 18 most frequent journals

Dimension	Indicator	Metric
Environmental Impact	CO2 emissions (or carbon footprint)	t
	CO2 intensity of energy supply	%
	CO2 intensity of the economy	%
	Nitrogen emissions (NOx)	t
Energy Consumption	life cycle energy use of product	kWh per time unit
	energy use during operation	kWh
	energy efficiency	%
	Energy use (total and per unit of product)	kWh
	Fresh water consumption	Liters
	Waste water	Liters
	Percent energy from renewables	%
	Solid waste	kg
	Hazardous waste	kg
	energy consumption	kWh
	level of clean technologies	%
	amount energy consumption during the recycling	kWh
Energy cost savings	monetary unit	
Material Use	Materials used (total and per unit of product)	kg
	level of recycled material in product (circularity degree)	%
	recycling time	hs/days
	reuse potential indicator	%
	longevity indicator	time unit
	global resource indicator	kg/functional unit
Strategy	ISO 14001 certification	y/n
	EMS	y/n
	RD&D spending	monetary unit
	number of new products and processes	monetary unit
	availability of eco-labeling	y/n
Commercial	Profits	monetary unit
	Return on investment	%
	Energy cost savings	monetary unit
	Turnover/employee (productivity)	%
	operational cost	monetary unit
	product quality	(technical) characteristics relevant
	eco-efficient value ratio	environmental burden to economic value

Table 3: Relevant indicators from literature review

Results from Pitchdeck Analysis

Indicator use per broad sector	clean energy use (35%)	energy efficiency (44%)	renewable generation and associated activities (16%)	waste management and recycling (12%)	Total
CO2 emissions (t and Δ)	10	7	1		18
energy efficiency (%)	3	6	4		13
cost (£)	3	3			6
waste (kg and Δ)		5		1	6
capital efficiency (%)	3	1	1		5
carbon footprint	2	3			5
degree of circularity (%)	2	3			5
Water quality (%)	1	2	1		4
chemicals (kg, t)	1	1		1	3
material usage (t)	1		2		3

Table 4: Ten most frequent indicators from pitchdecks

APPENDIX 2

Interview topic guide

Name:

Position:

Organisation:

What is the Relevant experience of you and your organization in working with: Cleantechs/green SMEs, Impact (environmental) Investors, Relevant Government Programmes (e.g. funding mechanisms/instruments/programmes- and associated public and private support)

Understanding of Business Growth, Progression, Policy and Measurements

How do corporate businesses and SMEs currently measure business growth and progression (probe for differences between corporates and SMEs, and what may be relevant to earlier stage, smaller, innovative green/cleantech SMEs)? *Note – we are interested in what is applicable to SMEs*

What types of measures do government support policies and programmes use (to select co-finance organisations (eg VCs) and recipient business beneficiaries and evaluate policy/programme impacts)?

What accounting/assessment measures are typically used that can assist? (*probe on what works well/less well and why?*)

Understanding of Impact investment measurements (ie *Green rather than pure growth aims*)

What do government and private investors use to screen for selection and assess their impact investments?

- Probe on how government selects green investment co-funding partners
- Probe on approaches and metrics used – formal versus informal

Probe on what is specifically used for environmental and low carbon investment metrics (as well as wider sustainability development goals)?

Assessment of the value of current approaches/metrics?

How effectively do current approaches and metrics for growth and sustainability (*focusing on environmental/low carbon*) work?

- Probe for examples of best practice
- Probe on where we can learn more from (source references, organisations – international approaches?)

How could these approaches (eg SDGs/CSR/CBA/EIA/SRI) and metrics (KPIs) be improved?

- Probe for relevance to early stage, smaller SMEs
- Probe for combination (weighting) of growth and sustainability
- Probe for environmental/ low carbon metrics

To what extent is circular economy (CE) and the wider impact of investment being screened for selection and evaluation purposes?

- Probe on what aspects of wider environment spillovers (supply chains, buyers, innovation clusters etc) that should be measured and how
- Probe on timelines required for sustainable impacts and recycling

What other aspects should be considered?

Summary of future recommendations

To summarise from existing evidence:

What are the most effective and useful screening selection approaches and metrics that combine environmental sustainability with growth that should be adopted by public and private investors?

What are the key evaluation approaches and measures that should be adopted by public support programmes to account for both environmental sustainability – low carbon growth impacts?

Do you have any other associated key recommendations for UK policymakers? (*please detail how these should be operationalized*)

Follow-up: key contacts/organisations/experts, key data and sources of reporting/information

Please provide suitable contacts we should follow-up and introductions where possible – these can include:

Policymakers – strategists (Government departments, and non departmental bodies)

Policy Think-tanks, lobbyists, advisors

Environmental Impact Investor Groups

Business support providers (e.g. specialist innovation and cleantech support hubs)

Private business support providers such as accountants

Market specialist key informants and academics

Suggested key case study cleantech businesses and their impact investors.

Please provide information of key literature, reports, evaluation, and data sources that may be useful?

Further support and engagement with the research:

Willingness to be re-interviewed, attend workshops, or hold workshops – Note we intend to gather information and test our findings and recommendations through workshops

REFERENCES

- Ahi, P. & Searcy, C. 2015. An analysis of metrics used to measure performance in green and sustainable supply chains. *Journal of Cleaner Production*, Vol. 86, pp. 360-377.
- Nightingale, A. 2009. A guide to systematic literature reviews. *Surgery (Oxford)*, Vol. 27, pp. 381-384.
- Tranfield, D., Denyer, D. & Smart, P. 2003. Towards a Methodology for Developing Evidence-Informed Management Knowledge by Means of Systematic Review. *British Journal of Management*, Vol. 14, pp. 207-222.
- Veleva, V. & Ellenbecker, M. 2001. Indicators of sustainable production: framework and methodology. *Journal of Cleaner Production*, Vol. 9, pp. 519-549.