

1 **Affordability Criteria for Industrial Sectors in the Design and Implementation of**
2 **Environmental Policies**

3
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11
12 **Abstract**

13 This paper presents a stepwise approach to integrate affordability criteria in the design
14 and implementation of environmental policies. The approach focuses on the affordability
15 of abatement measures for the industrial sector and is illustrated by means of case
16 studies for the beverages and textiles industry. These cases show that affordability
17 criteria can support policy makers in their assessment of potential Best Available
18 Techniques (BAT) under the Integrated Pollution Prevention and Control (IPPC) Directive
19 as well as in the assessment of alternative programmes of measures under the European
20 Water Framework Directive.

21
22 **Keywords:** economic appraisal, affordability, environmental policy, industrial sector,
23 IPPC, Water Framework Directive

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34 **1. Introduction**

35 For most goods and services, markets exist that match supply and demand. Adam
36 Smith's invisible hand ensures that, if all markets are perfectly competitive, resources
37 are allocated efficiently without the need for regulatory control (Smith, 1937). However,
38 one of the conditions that must hold before a market can be considered competitive, is
39 the existence of property rights for all goods and services in that market. In case of
40 pollution, this condition is already violated (Kolstad, 2000). Do polluters have the right to
41 pollute the air or do victims have the right to breathe clean air? From an efficiency point of
42 view the distribution of property rights is irrelevant if parties can bargain without
43 transaction costs and to their mutual advantage (Coase, 1960). Unfortunately, in real-
44 world situations polluter and victim face significant transaction costs so that the
45 application of the Coase theorem is limited (Kolstad, 2000). In addition, production and
46 consumption can generate externalities, such as pollution, which are not reflected in
47 market prices. These externalities can be a source of market failure. Consequently,
48 markets do not yield the socially optimal amount of pollution and government
49 interventions are desirable.

50

51 In case of government intervention, policy makers have to decide on the right level of
52 environmental protection. Environmental economists in general seek to maximise total
53 surplus (Kolstad, 2000; Żylicz, 2000). They estimate costs and benefits of each policy
54 alternative and select the alternative that maximises the difference between benefits and
55 costs. In literature dissenting views can be found about the kind of costs and benefits
56 that should be taken into account in such a decision-making process. Some authors
57 stress that external costs, imposed on other agents, should always be taken into
58 account. Consequently, policy makers should only focus on those environmental
59 measures for which social benefits, consisting of both private and external benefits, are
60 larger than social costs, consisting of both private and external costs (Pearce et al.,
61 2006). Moreover, they should not move away from this key question by looking at the
62 impact of a certain policy on a particular firm's or sector's economic viability (Bréchet &

63 Tulkens, 2009). Other authors stress that, when deciding on the introduction of
64 environmental measures, one should consider the both a private social benefit - cost
65 ratio and a social benefit - cost ratio (Georgopoulou et al., 2008).

66

67 The decision to exploit or protect the environment affects a large variety of economic
68 agents and within society there is typically no unanimity about the socially desirable level
69 of environmental protection (Kolstad, 2000). Therefore, policy makers are not only
70 concerned with the net social benefit of environmental measures, but also with the socio-
71 economic consequences for those who have to bear the costs of these measures (Oates
72 & Portney, 2003). The question arises whether these environmental measures are
73 affordable and an appropriate methodology to assess their affordability has to be chosen.

74

75 In this paper, we describe a stepwise approach to integrate affordability criteria in the
76 design and implementation of environmental policies. Our approach is based on criteria
77 found in literature. We focus on the affordability of technical abatement measures for
78 industry. Subsequently, we illustrate by means of case studies for the beverages and
79 textiles industry which cut-off points can be used to classify measures as (non)
80 affordable. We particularly look at the implementation of two European directives that
81 incorporate socio-economic issues, namely the Directive on Integrated Pollution
82 Prevention and Control (96/61/EC) or IPPC Directive and the Water Framework Directive
83 (2000/60/EG).

84

85 The IPPC Directive is the first European directive to address socio-economic aspects
86 explicitly in environmental legislation. This directive aims at minimizing pollution from
87 various industrial sources throughout the European Union. Operators of industrial
88 installations are required to obtain an environmental permit to operate from the
89 authorities in the EU countries. As defined in the IPPC Directive the permit conditions,
90 including emission limit values, must be based on the Best Available Techniques (BAT).
91 According to the IPPC Directive the concept of available techniques should be interpreted

92 as those techniques developed on a scale which allows implementation in the relevant
93 industrial sector, under economically and technically viable conditions, taking into
94 consideration the costs and advantages, ... , as long as they are reasonably accessible to
95 the operator.

96

97 Socio-economic considerations are also an integral part of the European Water
98 Framework Directive. The WFD sets ambitious objectives to ensure that all waters meet
99 good status by 2015. To ensure this, member states were obliged to publish river basin
100 management plans by the end of 2009. According to Article 11 and Annex III these
101 management plans had to include programmes of cost-effective reduction measures.
102 Hence, assessing cost and impact of emission reduction measures is an essential element
103 of a river basin management plan. If reaching the good status in a water body entails
104 disproportionate costs for certain agents (e.g. industry, agriculture), exemptions can be
105 granted (Article 4, WFD). In particular, the deadline for reaching the good status can be
106 extended or the objectives can become less stringent.

107

108

109 **2. Affordability approaches for industry**

110 To evaluate the affordability of abatement measures several approaches and models
111 exist, e.g. Reference Value Approach (Vercaemst, 2002), MIOW+ (Van der Woerd et al.,
112 1995; Dijkmans, 2000; Derden et al., 2002), DAFFIE (Vanassche et al., 2008) and BEAsT
113 (Georgopoulou et al., 2008). Although, all these approaches and models entail
114 disadvantages and shortcomings they can provide policy makers with useful insights and
115 decision support. In the following paragraphs we discuss the models and criteria and
116 propose a normative approach for their application.

117
118 The Reference Value Approach can be applied on firm or sector level to address the
119 annual costs of abatement measures relative to turnover, gross profit and added value
120 and the share of total investment costs of abatement measures in the total average
121 investment costs of the past 5 years. Indicative reference values provide an upper
122 boundary for annual costs or investments that are definitely affordable and a lower
123 boundary for annual costs or investments that are definitely not affordable (table 1).

124
125 Table 1. Indicative reference values

<i>Annual costs relative to...</i>	<i>Acceptable</i>	<i>To be discussed</i>	<i>Unacceptable</i>
Turnover	< 0,5 %	0,5 - 5 %	> 5 %
Gross profit	< 10 %	10 - 100 %	> 100 %
Added value	< 2 %	2 - 50 %	> 50 %
<i>Investment costs relative to...</i>			
Average total investments of the past 5 years	< 10 %	10 - 100 %	> 100 %

126 Source: (Vercaemst, 2002)

127
128 If measures or techniques are clearly affordable or not affordable, no further
129 investigation is needed. However, there is a large interval between the lower and upper
130 bound where further investigation is needed to be able to draw a conclusion. Hence, the
131 main shortcoming of the reference value approach is that it often does not provide
132 conclusive judgment about the affordability of abatement measures. Nevertheless, the

133 reference value approach is useful to filter out environmental measures with on the one
134 hand yearly costs that are extremely high or on the other hand extremely low in
135 comparison to the financial results of the firms under consideration.

136
137 In the MIOW+ model, a firm's liquidity position, long term solvability and profitability
138 position as well as its competitive position is taken into account. In a first stage this
139 information is used to calculate a score that indicates the firm's resilience. In a second
140 stage the impact of an environmental investment is estimated by recalculating this
141 resilience score by taking into account the effect of the environmental investment on
142 liquidity, solvability and profitability (Van der Woerd et al., 1995). The main disadvantage
143 of this model is that it is designed for assessing the impact of investments made by large
144 individual companies, and therefore the model is less suitable for evaluating the viability
145 of environmental investments for a group of companies (e.g., sector) or small- and
146 medium-sized enterprises. Furthermore, by using a single score for resilience the model
147 presents the financial situation in a rather rudimentary manner which leaves little room
148 for nuances.

149
150 The DAFFIE (Decision Aid Framework For Investments in Environment) model (Vanassche
151 et al., 2008) relies on the FiTo®-meter developed by Ooghe & Spaenjers (2006) and
152 uses 8 key financial ratios to estimate the impact of environmental investments on the
153 financial situation of a firm or sector. DAFFIE has the advantage that it can be applied on
154 different scale levels: an entire industry as well as an individual company and large as
155 well as small- and medium-sized enterprises. In addition, it provides a more conclusive
156 outcome for all types of environmental investments than the reference value approach.
157 Furthermore, DAFFIE benchmarks each firm or industry against a reference group and
158 uses this relative position, rather than absolute boundaries, to determine the affordability
159 of environmental investments. The main weakness of this model is that it fails to take
160 into account the competitive position of a firm or sector. When considered relevant, the
161 competitive position has to be discussed in a qualitative manner.

162 BEAsT (Georgopoulou et al., 2008) is a decision-support tool for public and private
163 administrators and managers which offers rapid assessment of different Best Available
164 Techniques both in terms of economic and environmental costs and benefits. The
165 synthesis of economic costs and benefits is carried out by means of a Cost-Benefit
166 Analysis. In order to calculate total costs and benefits, all cash flows are reduced into the
167 same reference year using the Present Value approach. A technique is considered
168 economically attractive when the benefit to cost ratio is greater than 1. The economic
169 evaluation can be done either by considering only private economic costs or by also
170 incorporating the cost of environmental externalities (social cost). These criteria also
171 constitute the main disadvantage of the tool as they do not provide any insight on the
172 affordability to the firm of measures that have a social benefit to cost ratio greater than 1
173 and a private benefit to cost ratio smaller than 1.

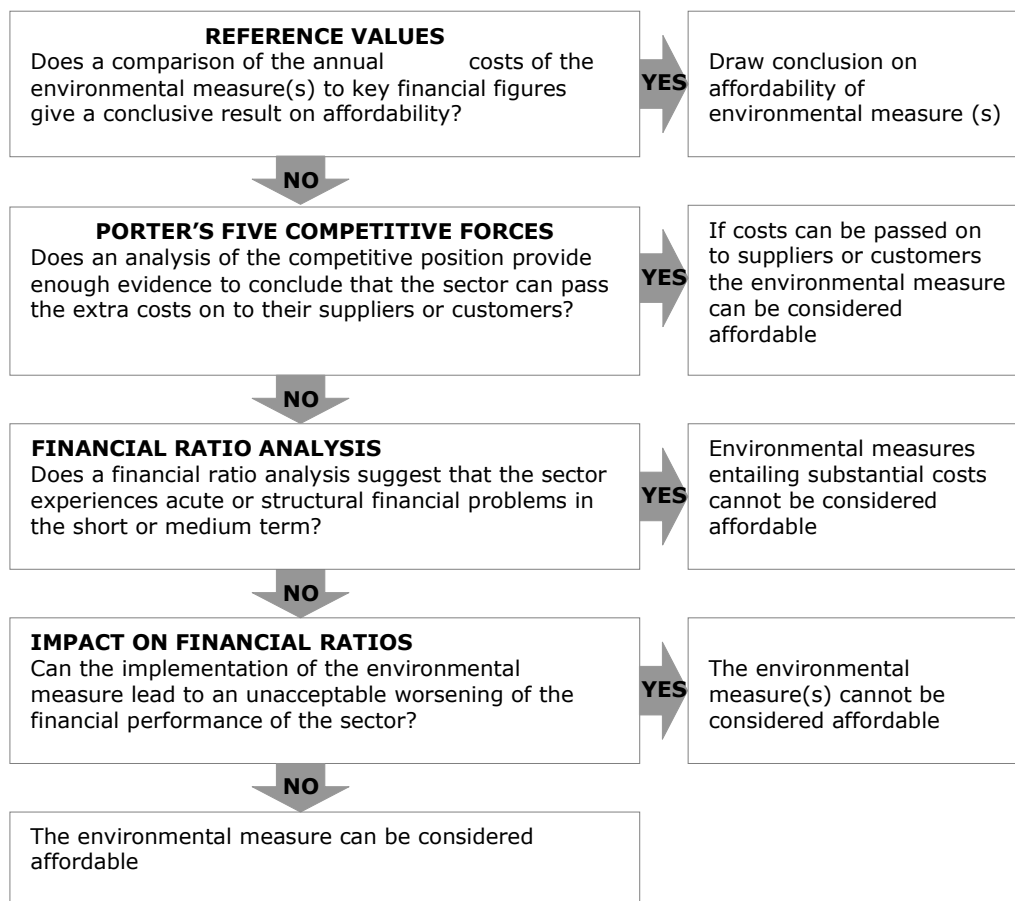
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176 **3. Integrated Stepwise Affordability Approaches (ISAA)**

177 We integrated the above-mentioned models to improve the affordability assessment of
 178 technical abatement measures for industry by using a three step procedure. The figure
 179 below summarizes the different steps.

180



181

182 Figure 1. Consecutive steps of an affordability assessment of technical abatement
 183 measures for industry

184

185 First, the additional costs of the environmental measures are compared to some key
 186 financial figures of a representative firm. Often, a (fictional) firm with average size and
 187 financial performance is considered representative. In case of a diverse sector, the
 188 assessment is balanced by making a distinction between subsectors or size classes. The
 189 annual costs of abatement measures are compared to turnover, gross profit and added
 190 value of a representative firm. In addition, investment costs of abatement measures are

191 compared to the average total investments over the past 5 years. The indicative
192 reference values in table 1 provide an upper boundary for abatement measures that are
193 definitely affordable and a lower boundary for abatement measures that are definitely not
194 affordable. Between these boundaries there is a large interval where further assessment
195 is needed and guided in the following steps.

196

197 Second, an extended affordability analysis considers the competitiveness of the sector.
198 Porter's five forces framework is used to describe a firm's or sector's competitive position
199 (Porter, 1980, 1985). According to Porter's view, the rules of competition are embodied
200 in five forces that shape the structure and intensity of competition: (i) the entry of new
201 competitors, (ii) the threat of substitutes, (iii) the bargaining power of buyers, (iv) the
202 bargaining power of suppliers, and (v) the rivalry among the existing competitors. The
203 strength of these five forces varies between industries, and can change as an industry
204 evolves. An appraisal of Porter's five forces is done qualitatively, based on literature
205 review or expert interviews.

206

207 Third, if competition is high and the sector cannot shift its additional costs to its suppliers
208 or customers, a more detailed financial ratio analysis is needed. For assessing the
209 financial situation of the sector a number of financial ratios has to be selected that
210 represent each of the four areas of financial health: profitability, value added, solvability
211 and liquidity. By comparing the ratios of the sector in question with those of the entire
212 industry, we get an indication of the relative financial health of the sector.

213

214 In the final step, we determine the impact of an additional investment on the financial
215 health of the sector. For this purpose, financial data is extracted from the annual
216 accounts of an average firm in the sector. These accounts refer to the four latest years
217 available and are averaged to flatten out yearly fluctuations in the annual accounts. On
218 the one hand we adapt the accounts for related investment, operational, maintenance
219 and avoided costs as well as additional income, depreciation. On the other hand we take

220 the impact of an additional loan on the balance sheet and profit-and-loss account into
221 account. Based on the simulated account, we recalculate the financial ratios that
222 represent the financial health of the sector and are selected in the previous step.

223

224 **4. Case studies: IPPC and WFD**

225 In the following paragraphs we discuss two cases for different industrial sectors in
226 Flanders. The first case illustrates how ISAA supported the BAT selection process (IPPC
227 Directive). The second case illustrates how ISAA was used for justifying time exemptions
228 in the first generation of river basin management plans (Water Framework Directive). It
229 is important to note that for each of these case studies stakeholders were consulted in
230 order to guarantee the appropriateness and workability of the approach. In case of the
231 Flemish BAT studies a steering committee, composed of representatives from industry
232 and competent authorities, gathered three to five times during the course of the study.
233 This steering committee was on the one hand responsible for supplying data and
234 information. On the other hand results of the BAT evaluation, including the assessment of
235 the affordability of candidate BAT, were discussed with the steering committee in order to
236 reach a consensus on the conclusions. In the case of the WFD, the draft river basin
237 management plans, including the assessment of the affordability of the programme of
238 measures, were subject to public consultation. The final river management plans were
239 approved by the Flemish Government.

240

241 **4.1 BAT evaluation for the beverages industry**

242 Within the framework of selecting BATs for the Flemish beverages industry (Derden *et*
243 *al.*, 2008) the affordability of phosphorus removal from the wastewater of malting plants,
244 large breweries and large producers of mineral waters and soft drinks was assessed. This
245 assessment included a description of the sector and its international competitive position
246 as well as a financial ratio analysis and a comparison of the costs of phosphorus removal
247 with the reference values in table 1.

248

249 The description of the sector illustrated the evolution of turnover, value added and profits
 250 in the beverage industry and its sub-sectors between 1999 and 2006. With the exception
 251 of a status quo in the large breweries, this evolution was marked by growth. The Flemish
 252 beverages industry consisted of a large number of small and medium sized enterprises
 253 and a small number of international firms.

254
 255 The affordability check focused on the latter firms as phosphorus removal was only
 256 relevant for these larger production plants. Table 2 depicts annual costs relative to
 257 turnover, gross profit and added value in 2005 and the share of total investment costs of
 258 phosphorus removal in the total average investment costs over the period 2000-2005.
 259 The results indicated that the costs of phosphorus removal are clearly affordable for the
 260 three sub-sectors under consideration.

261
 262 Table 2. Comparison of the annual costs of phosphorus removal with turnover, value
 263 added and gross profits in 2005 and of the investment costs of phosphorus removal
 264 relative to total average investments over the period 2000-2005

	<i>Breweries</i>		<i>Malting plants</i>		<i>Mineral waters and soft drinks</i>	
	%	Affordable?	%	Affordable?	%	Affordable?
Turnover	0,16	yes (<0,5%)	0,13	yes (<0,5%)	0,07	yes (<0,5%)
Value added	0,41	yes (<2%)	1,39	yes (<2%)	0,42	yes (<2%)
Gross profits	2,92	yes (<10%)	4,91	yes (<10%)	2,50	yes (<10%)
Investments	1,22	yes (<10%)	0,10	yes (<10%)	2,02	yes (<10%)

265 Source: (Derden *et al.*, 2008)

266
 267 Although the application of the reference values approach led to a conclusive result, we
 268 chose, in consultation with industry and policy makers, to take the analysis a few steps
 269 further. Therefore we included an analysis of the competitive position of the firms and
 270 financial ratios in order to present a more comprehensive overview of the sector and
 271 their ability to invest in environmental measures.

272 The appraisal of the competitive position of the industry showed that although the larger
273 firms took up a prominent place in the world market, they had little or no ability to
274 transfer additional environmental costs to suppliers or customers. The latter was
275 explained by the price-setting of their raw materials (mainly cereals for malting plants
276 and breweries) on the international markets. Since their product was mainly sold to large
277 supermarket chains within the retail business, the producers of beverages were left with
278 little bargaining power to transfer environmental costs to the customers.

279

280 The financial ratio analysis was performed on the basis of the FiTo®-meter. The FiTo®-
281 meter is made up of eight financial ratios and the FiTo®-score which is the average of
282 the logarithm of these eight ratios (Ooghe & Spaenjers, 2006). A FiTo®-score above
283 0.5506 indicates that the sector is financially healthy in the short and medium term. A
284 FiTo®-score below 0.5506 and above 0.5313 means the sector has structural financial
285 problems in the medium term and a FiTo®-score below 0.5313 signals acute financial
286 problems in the short run and structural financial problems in the medium term. These
287 thresholds are valid for the financial year of 2006. The thresholds for Belgian companies
288 are recalculated each year by Graydon N.V. on the basis of annual statements of account
289 submitted to the National Bank of Belgium. Substantial additional costs related to
290 environmental measures are considered not affordable for the sectors with financial
291 distress in the short or medium run, meaning with FiTo®-scores below 0.5506.

292

293

294 Table 3 shows the median of the ratios on which the FiTo®-scores are based for each
 295 sub-sector of the beverages industry.

296

297 Table 3. FiTo®-scores of the large breweries, malting plants and producers of mineral
 298 waters and soft drinks

Ratio #	Breweries (22)		Malting plants (9)		Mineral waters and soft drinks (29)	
	Median	Position	Median	Position	Median	Position
1. Gross value added/personnel costs	224,0	78	158,0	59	142,0	38
2. Net return on operating assets before taxes	237,5	100	228,0	99	56,0	96
3. Net return on share. funds after taxes	6,0	49	10,0	49	7,0	46
4. Self financing quote	28,0	68	62,0	90	14,0	47
5. Financial independence ratio	48,5	74	67,0	84	30,0	46
6. Short term debt ratio	0,0	100	0,0	100	0,0	100
7. Coverage of external liabilities by cash flow	24,0	64	31,0	74	11,0	39
8. Net treasury ratio	10,5	68	45,0	82	27,0	66
FiTo®-score	0,6280	91	0,6379	93	0,5709	55

299 Source: (Derden *et al.*, 2008)

300

301 The ratios were calculated for 2005 since these were the most recent data available. The
 302 figures between brackets depict the number of companies in the respective sub-sector.
 303 The "Position"- column shows the relative position in percentiles (0: minimum value –
 304 100: maximum value) of the median of each ratio with respect to the entire Flemish
 305 industry. The higher the position, the better the sector performs compared to the entire
 306 Flemish industry.

307

308 Furthermore, the table shows that the large breweries and malting plants have a good
 309 financial health with respect to the entire Flemish industry. The median FiTo®-score for

310 the large breweries and malting plants was situated respectively in the 91st and 93rd
311 percentile of the Flemish industry. Although the producers of mineral waters and soft
312 drinks had a somewhat lower score, their situation was not considered problematic as
313 none of the ratios was exceptionally low. In addition, the FiTo®-score was still above the
314 threshold value for financial health. In general, the ratio analysis showed that the sub-
315 sectors were able to absorb the additional costs of phosphorous removal.

316

317 In summary, the analysis indicated that although the firms under consideration had very
318 limited possibilities for transferring additional costs of phosphorous removal to the
319 suppliers or customers, they were able to absorb these costs themselves. In addition, the
320 costs were considered to be affordable as they were small enough in comparison with the
321 average turnover, value added, gross profits and other investments.

322

323 **4.2 Programme of measures textiles industry under the Water Framework** 324 **Directive**

325 Within the framework of the first generation of river basin management plans the
326 affordability of abatement measures was assessed for industry (Meynaerts et al., 2009).
327 The abatement measures under consideration were mainly related to sustainable water
328 use and improvement of surface and groundwater quality. On the one hand a package of
329 measures was defined that contributes to reaching good status by 2015 (maximum
330 scenario) as imposed by the European Water Framework Directive. On the other hand a
331 package of measures was defined that was cost-effective and affordable but not sufficient
332 to reach good status by 2015 (scenario time derogation). Derogation in time - that is
333 achieving good status by 2021 or 2027 - is allowed by the WFD if reaching good status
334 by 2015 is technically infeasible and/or gives rise to disproportionate costs. In Flanders
335 the assessment of disproportionate costs involved the assessment of the costs and
336 benefits as well as the affordability of the proposed package of abatement measures.

337

338 In 2005 – 2007 the gross value added of total industry in Flanders (NACE 14 – 36) was
339 on average 33.280 million euro (National Bank of Belgium). Total annual costs of the
340 scenario time derogation were estimated to amount 198 – 340 million euro per year,
341 whereas total costs of the maximum scenario were estimated tot amount 239 - 398
342 million euro per year. Although the share of these costs in the gross value added was
343 less than 2%, a more detailed analysis was suggested. Firstly, the gross added value was
344 not only based on the activities of firms that would have to bear the costs of the
345 proposed package of abatement measures. Secondly, the costs of some of the abatement
346 measures were marked as highly uncertain so that a more detailed analysis seemed
347 appropriate.

348

349 A more detailed assessment was done for the textiles industry (NACE 17 and 18) based
350 solely on financial information of the firms that had to bear the costs of the proposed
351 package of measures. Only for two abatement measures the costs could be assigned to
352 specific firms. For these firms financial information was collected about turnover, gross
353 value added, profit and investments.

354

355 Table 4 compares total annual costs (1,1 million euro) or investments (4,3 million euro)
 356 of the two abatement measures with the financial parameters. The resulting ratios are
 357 assessed on sector level as well as on firm level, using the reference values of table 1.

358

359 Table 4. Ratio analysis textiles industry

	Ratio	Affordable at sector level?	Affordable at firm level (% of firms)		
			Yes	To be discussed	No
Annual cost relative to					
Turnover	0,09%	Yes (<0,5%)	65%	24%	12%
Gross profit	2,53%	Yes (<10%)	33%	13%	54%
Gross Value Added	0,33%	Yes (<2%)	71%	17%	13%
Investment costs relative to					
Total investments	4,17%	Yes (<10%)	50%	22%	28%

360 Source: (Meynaerts et al., 2009)

361

362 For the entire textiles industry, the abatement measures seemed to be affordable on
 363 average. However, for a considerable number of firms this was not the case. For 54% of
 364 the firms, the abatement measures were not affordable based on the ratio of annual cost
 365 relative to gross profit.

366

367

368 **5. Conclusions and discussion**

369 The case studies presented in this paper show that affordability criteria can support
370 policy makers in their assessment of candidate BAT under the IPPC Directive as well as in
371 the assessment of alternative programmes of measures to achieve good water status
372 under the European Water Framework Directive. The integrated stepwise approach was
373 an important tool for objectifying the discussion between industry and policymakers
374 about the affordability of environmental measures. By combining the various affordability
375 criteria policy makers and industry representatives obtained a clearer understanding of
376 the financial situation of sectors and the possible economic impact of environmental
377 policy. However, in applying the stepwise approach we identified a number of issues that
378 are subject to further discussion or research.

379

380 Although the stepwise approach offered a consistent framework to avoid arbitrary
381 decision making, expert judgement and negotiation remained essential in defining and
382 implementing environmental policy. This aspect was confirmed by (Aurora & Donnan,
383 2006), who also concluded that affordability assessments on itself seldom yield
384 conclusive results but are valuable in complementing other economic tools such as cost-
385 benefit analysis to make informed choices.

386

387 Secondly, it should be noted that the approach concentrates on the affordability of
388 technical abatement measures for an average firm of an industrial sector in Flanders. We
389 found that in many cases it is not obvious how to define the average firm that is subject
390 to the affordability analysis. Expert judgement or consultation with the sector under
391 consideration can be of use here. Furthermore, the results of the affordability assessment
392 for an average firm in a sector should not be generalized as large variations in economic
393 performance may exist between firms within a sector. The latter was illustrated for the
394 textiles industry in Flanders in table 4.

395

396 Thirdly, since different accounting rules are used for the primary and secondary sector,
397 affordability criteria for the agricultural sector should be addressed separately. The
398 difference in accounting rules holds specifically for the European agricultural sector which
399 is largely dominated by family farms.

400

401 Fourthly, wide-ranging empirical work on the political economy of environmental
402 regulation support the view that next to socio-economic criteria, policymakers take into
403 account political criteria when deciding on governmental interventions. (Oates & Portney,
404 2003), for example, explore the various political, or collective choice, aspects of
405 environmental policymaking. However, in-depth research needs to be undertaken to
406 obtain a clearer understanding of the relationship between the political process and the
407 use of affordability criteria in the design and implementation of environmental policy.

408

409 Finally, the applicability of the integrated stepwise approach is limited in time and space
410 and depends strongly on the availability of cost and financial data. In the case studies we
411 focused on the financial position of the average firm relative to the industry in Flanders.
412 An EU wide analysis or application in non-EU countries will either require new thresholds
413 for financial health to be set or the replacement of the thresholds by expert judgement.

414

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418

419

420 **References**

- 421 Aurora S. & Donnan J. (2006) Extracting objective criteria from subjective judgments –
422 affordability, competitiveness and sustainability of environmental regulation:
423 International Journal of Environment, Workplace and Employment v. 2, p. 251 -
424 302.
- 425 Bréchet T. & Tulkens H. (2009) Beyond BAT: Selecting optimal combinations of available
426 techniques, with an example from the limestone industry: Journal of
427 Environmental Management, v. 90, p. 1790-1801.
- 428 Coase R. H. (1960) The problem of social cost: Journal of Law and Economics v. 3, p. 1-
429 44.
- 430 Derden A., Vanassche S., Hooyberghs E. & Huybrechts D. (2008) Beste Beschikbare
431 Technieken (BBT) voor de drankenindustrie (Best Available Techniques (BAT) for
432 the beverages industry): Gent, Academia Press, xvi+453 p.
- 433 Derden A., Vercaemst P. & Dijkmans R. (2002) Best available techniques (BAT) for the
434 fruit and vegetable processing industry: Resources, Conservation and Recycling,
435 v. 34, p. 261-271.
- 436 Dijkmans R. (2000) Methodology for selection of best available techniques (BAT) at the
437 sector level: Journal of Cleaner Production, v. 8, p. 11-21.
- 438 Georgopoulou E., Hontou V., Gakis N., Sarafidis Y., Mirasgedis S., Lalas D. P., Loukatos
439 A., Gargoulas N., Mentzis A., Economidis D., Triantafilopoulos T. & Korizi K.
440 (2008) BEAsT: a decision-support tool for assessing the environmental benefits
441 and the economic attractiveness of best available techniques in industry: Journal
442 of Cleaner Production, v. 16, p. 359-373.
- 443 Kolstad C. D. (2000) Environmental Economics, Oxford University Press.
- 444 Meynaerts E., Broekx S., Liekens I., Vanassche S. & De Nocker L. (2009) Ontwikkelen
445 van een economisch kader voor de beoordeling van disproportionaliteit van het
446 maatregelenprogramma voor de kaderrichtlijn Water, VITO NV, Mol, 194 p.
- 447 Oates W. E. & Portney P. R. (2003) Handbook of Environmental Economics - Chapter 8
448 The political economy of environmental policy, v. 1, Elsevier, p. 325-354.

449 Ooghe H. & Spaenjers C. (2006) The financial state of the Belgian companies 2006;
450 Ratios and total score on the basis of the FiTo(r)-meter 1995-2006, Ghent,
451 Department of Accountancy and Corporate Finance Ghent University.

452 Pearce D., Atkinson G. & Mourato S. (2006) Cost-benefit analysis and the environment,
453 OECD.

454 Porter M. (1980) Competitive strategy - techniques for analyzing industries and
455 competitors, The Free Press.

456 Porter M. (1985) Competitive advantage - creating and sustaining superior performance,
457 The Free Press.

458 Smith A. (1937) An Inquiry into the Nature and Causes of the Wealth of Nations. New
459 York, Random House.

460 Van der Woerd K. F., van Rijn I. A. W., Rosdorff S., Masurel E., van Everdingen Y. M. &
461 Dellink R. B. (1995) MIOW+; background to the model, Institute for
462 Environmental Studies, Vrije Universiteit Amsterdam, Amsterdam.

463 Vanassche S., Vranken L. & Vercaemst P. (2008) Decision Aid Framework For
464 Investments in Environment (DAFFIE). Investing in the environment; when is it
465 too much?: Environmental Economics and Investment Assessment II.

466 Vercaemst P. (2002) BAT: when do Best Available Techniques become Barely Affordable
467 Technology? : Paper for the European workshop (DG Enterprise) 'Economic
468 consequences of the IPPC Directive'.

469 Żylicz T. (2000) Goals, principles and constraints in environmental policies, *in* Folmer H.
470 & Gabel H. L., eds., Principles of Environmental and Resource Economics A Guide
471 for Students and Decision-Makers: Cheltenham, UK, Edward Elgar.