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Application Patterns of Life Cycle Assessment in German, Italian, Swedish and Swiss Companies.

Comparative Results and Conclusions

Schriftenreihe des IÖW 130/98



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INSTITUT FÜR
ÖKOLOGISCHE WIRTSCHAFTSFORSCHUNG

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**Application Patterns of Life Cycle Assessment in
German, Italian, Swedish and Swiss Companies.
Comparative Results and Conclusions**

Publication within the framework of the project „The
use of Life-Cycle-Assessment within business
decision-making processes and its implications for
environmental policy“ supported by the European
Commission DG XII (Environment and Climate
Programme)

Schriftenreihe des IÖW 130/98

Berlin/ Heidelberg 1998

ISBN 3-932092-29-5

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0 Preface

This report¹ is part of the research results achieved in the project „The Use of LCA's in Business Decision-making Processes and its Implications for Environmental Policy“ supported by DG XII within the framework of European Community's „Climate and Environment“-Programme. The project is carried out by five institutes:

- Institut für ökologische Wirtschaftsforschung gGmbH, Heidelberg (Germany) (also the co-ordinator of the whole project);
- Istituto Ricerche Ambiente Italia, Milano (Italy);
- Gothenburg Research Institute, Gothenburg (Sweden);
- Institute for Prospective Technological Studies of the European Commission - Joint Research Centre, Seville (Spain);
- ökoscience Beratung AG, Zurich (Switzerland).

The objectives of this project are to

- make a comprehensive inventory of LCA applications;
- examine the role of LCA techniques within business decision making;
- identify the factors influencing this role in a negative and positive way (barriers and opportunities);
- examine the links of business decision-making and their implications for environmental politics and analyse the relevance of LCA for public environmental politics.

Altogether the research focuses on two key issues:

- i) On the one hand, the project concentrates on the use of LCAs within business decision-making processes. The influence of LCA on business decision-making processes is analysed within the framework of this project.
- ii) On the other hand, the project examines the relevance of LCA to politics, i.e. the expectations of business as to policy-making activities and of policy-makers as to the business use of LCA.

The **first issue** is explored through a set of at least 20 case-studies of the use of LCA in business (selected countries: Germany, Italy, Sweden, Switzerland). These case-studies include enterprises of different branches and sizes. This part is supplemented by a survey of environmental product management in these four countries. The **second issue** is explored by examining the European environmental politics focusing particularly on product-oriented environmental policy and the analysis of the role LCA plays in the European environmental politics portfolio and in selected political areas.

The survey included in the first issue was carried out in spring 1997 in line with a questionnaire that was standardised and used for the four countries mentioned above (Germany, Italy, Sweden and Switzerland). This paper reports on the most important results of these four surveys which were

¹ We wish to thank Stephan Busch for his technical support, Ralf Antes for his critical remarks and the colleagues of Ambiente Italia, GRI, Oekosciene for their work carried out within the project.

delivered separately¹.

Chapter 1 reports on the methodology, present information on the sample, the return rates and some interesting aspects of the responding companies.

Chapter 2 reports on motivations to perform LCA-studies. **Chapter 3** describes experiences of the application of LCA. **Chapter 4** discusses the techniques of the application and carrying-out of LCA-studies. **Chapter 5** focuses on obstacles and the future. **Chapter 6** contains an analysis of the relationship between LCA and product innovation. **Chapter 7** is dedicated to the relationship between governmental environmental politics and LCA. Our report ends with some conclusions in **Chapter 8**.

However, this paper does not report on each result contained in the four national reports. It focuses on interesting findings and results and considers differences between the four countries concerned. Therefore, interested readers are referred to the national reports for more details.

1 Introduction

In this chapter, we describe method (section 1.1), sample (section 1.2) and the evaluation technique (section 1.3). In addition, part of the information of the sample of the companies returning the questionnaires is presented (sections 1.4 and 1.5).

1.1 Method

As already mentioned, a survey of the application of LCA in four different European countries (namely Germany, Italy, Sweden and Switzerland) was carried out within the project „The Use of LCA's in Business Decision-making Processes and its Implications for Environmental Policy“. A questionnaire² has been compiled by all members of the project team. It consisted of five parts:

- I. General information on the company,
- II. The company and environmental matters,
- III. Product innovation and the environment,
- IV. The use of LCA,
- V. Future public environmental policy in the area.

Altogether, the questionnaire consisted of 35 questions. Nearly all of these were closed questions, many of them asked for rankings. The questionnaire was sent to the companies and these were asked for a written answer.

1.2 The sample

In each of the four countries, it was agreed that approximately 400 different companies would be selected. The companies were chosen according to two criteria:

¹ The German report (Rubik 1998) and the Swedish report (Beckman/Baumann 1998) have been published, the other reports (von Däniken/Meier 1998, Mirulla 1998) not yet.

² The questionnaire is added as annexe to this report in chapter 10.

1. Environmentally oriented companies: They were selected according to the following criteria:
 - **Germany:** Availability of environmental business reports displaying and outstanding quality; product-specific characteristics within the environmental reports; existence of an LCA-study; membership of German „green“ industrial associations (UnternehmensGrün, B.A.U.M. - Bundesdeutscher Arbeitskreis umweltbewußtes Management, future); winners of environmental prizes or former clients of IÖW.
 - **Italy:** Selection from the database of Ambiente Italia.
 - **Sweden:** membership of Swedish industrial organisations (Näringslivets Miljö Chefer), of ICC (Business Charter for Sustainable Development) or of Naturliga Steget.
 - **Switzerland:** membership of ÖBU (Schweizerische Vereinigung für ökologisch bewußte Unternehmensführung) and of companies which are certified according to ISO 14000 or EMAS.
2. Largest companies selected according to their turnover in 1996.

The mailing began in April and ended in May 1997. If possible, questionnaires were sent either to persons within the companies known to the institutes carrying out the study or to environmental departments.

Table 1.1: Sample and response rates

	Switzerland (CH)	Germany (D)	Italy (I)	Sweden (S)	Total
Total number of questionnaires	403	410	400	412	1625
• to „environmental“ oriented companies	252	200	100	182	734
• to largest companies	151	210	300	230	891
Answers (absolute number)	82	101	30	169	382
Answers (in %)	20%	25%	8%	41%	24%
• from „environmental“ oriented companies	43	59	10	49	161
• from largest companies	18	45	6	72	141
• from „environmental“ oriented and largest companies ⁴	21	-	14	48	83
LCA users	44	62	18	66	190
LCA users' share of total number ⁵	11%	15%	5%	16%	12%
LCA users' share of respondents	54%	61%	60%	39%	50%

The sample and the response rates are presented in Table 1.1. A total of 1,625 companies received the questionnaire. 734 of these belong to the first group of environmental-oriented companies; 891 to the second group of large companies. 382 usable and completed questionnaires were returned, a number corresponding to an average response rate of 23.5%. The figures and shares of the four coun-

⁴ This classification has been relevant not in all of the countries.

⁵ Of course, we do not know how many LCA users there are among the non-respondents.

tries differ considerably: In Italy, the return rate was 7.5%, in Germany 24.6%, in Switzerland 20.4 % and in Sweden 41%. However, these quotas correspond to the expected return rate for each country due to the different specific national response „cultures“.

1.3 Method of evaluation

The returned questionnaires were collected and evaluated by the corresponding leading national institutes. Their reports were drawn up according to an internally agreed structure. The national reports have been published separately.

As already mentioned, the questionnaire consisted of 35 questions. All of these were closed questions, the majority of which multiple-choice-questions offering several answer possibilities and allowing several answers; the number of allowed answers varied. Some questions offered rankings from „None“ to „Crucial“.

Companies not answering a question or to a part of a question were generally as „refusal“ - but only with regard to the specific question or subquestion. Refusals were excluded from any calculation, but they have been reported in order to assess their importance.

Questions involving a ranking were weighted in accordance with the following method: points allocated to the different answer possibilities (none = 1 point, low = 2 points, medium = 3 points, influential = 4 points, crucial = 5 points). Refusals were excluded. The average values were calculated by means of the following formula:

$$\text{Average value} = (1 \cdot x_i + 2 \cdot x_j + 3 \cdot x_k + 4 \cdot x_l + 5 \cdot x_m) / (x_i + x_j + x_k + x_l + x_m)$$

i.e. refusals and „Don't know“ answers were not taken into consideration in these calculations and calculated averages⁵.

No analytical statistical evaluation was made; however, a descriptive statistics was carried out. For this purpose, the companies were separated into two groups according to a filtering question:

- companies which declared to use LCA
- companies which declared **not** to use LCA

We also tried to aggregate complex information on rankings. Several possibilities have been proved. We refer to the rankings and visualise the information in two ways: by figures, and by tables reporting a qualitative order by an A-B-C evaluation. The „A“ refers to the three first positions of the ranking list (according to the arithmetic means), while the last three positions of the same list correspond to a „C“. All positions in between get a „B“. Herewith, we obtained an impression of the relative national order and tried to look for the patterns.

In a few cases we also compared the results of companies using and those not using LCA. For this purpose, we used the results of the survey of LCA-using companies and divided these figures by the results of the companies which do not use LCA. The specific findings of this procedure are presented

⁵ However, the number of refusals is reported in the national reports (see Beckman/Baumann 1998, Mirulla 1998, von Däniken/Maier 1998 and Rubik 1998).

as (relative) percentages.

1.4 National or international corporation?

Within the sample of the returned questionnaires, it is interesting to analyse the national independence or the dependence on multinational corporations with regard to the results of the responding companies (see Figure 1.1)⁶. Especially those Italian companies returning the questionnaire are part of multinational corporations. But among those responding, Swedish multinational companies are also strongly more represented in the survey.

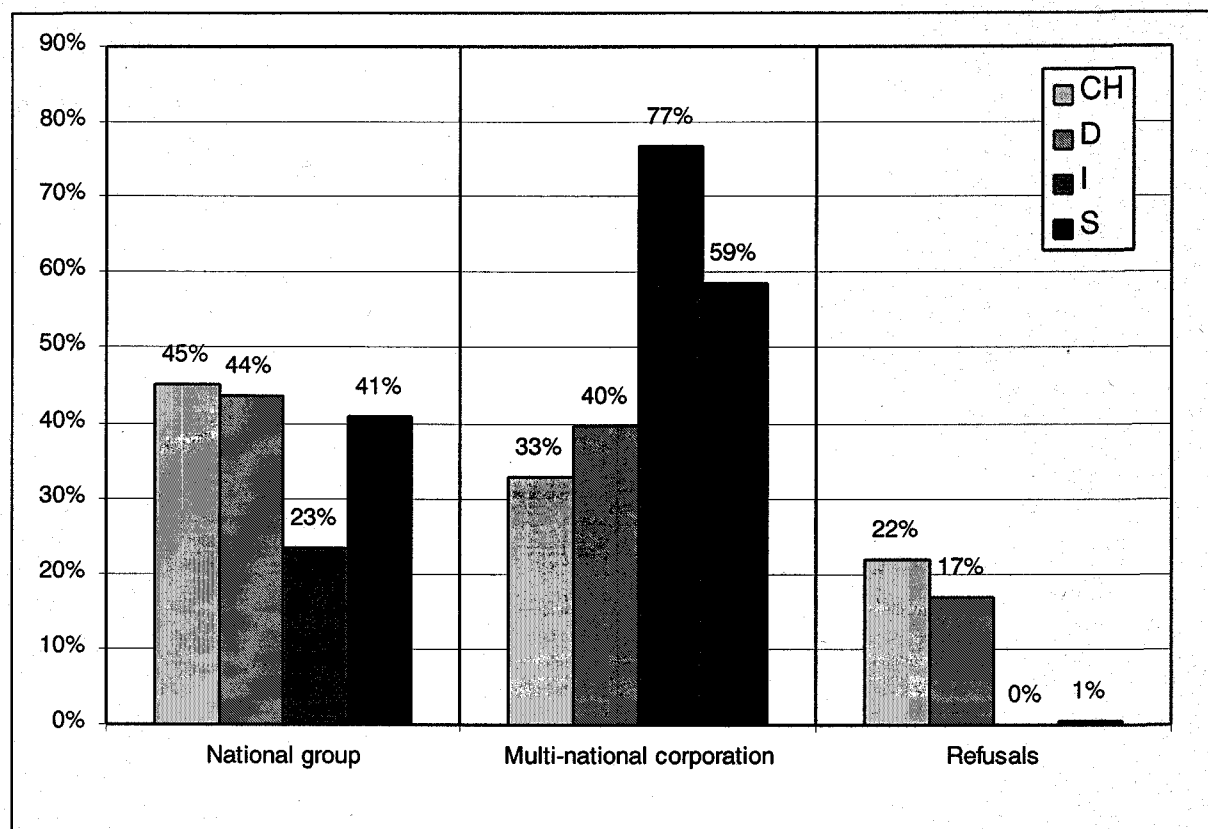


Figure 1.1: Corporation of the answering companies in the four countries (relative shares in % of respondents in each country)

1.5 Size

It is also interesting to consider the size of the responding companies (see Figure 1.2)⁷. The subdivision is in line with the classification according to the official classification of Eurostat.

19% of all answering companies are SME's⁸. Especially in Switzerland, a lot of SME's answered. This is also due to the specific Swiss economic structure with a lot of relatively small companies.

⁶ One answer was allowed.

⁷ One answer was allowed.

⁸ According to the criterion „number of employees below 250“. One also has to keep in mind that at least 50% of the companies in the sample have to be large companies according to the selection method.

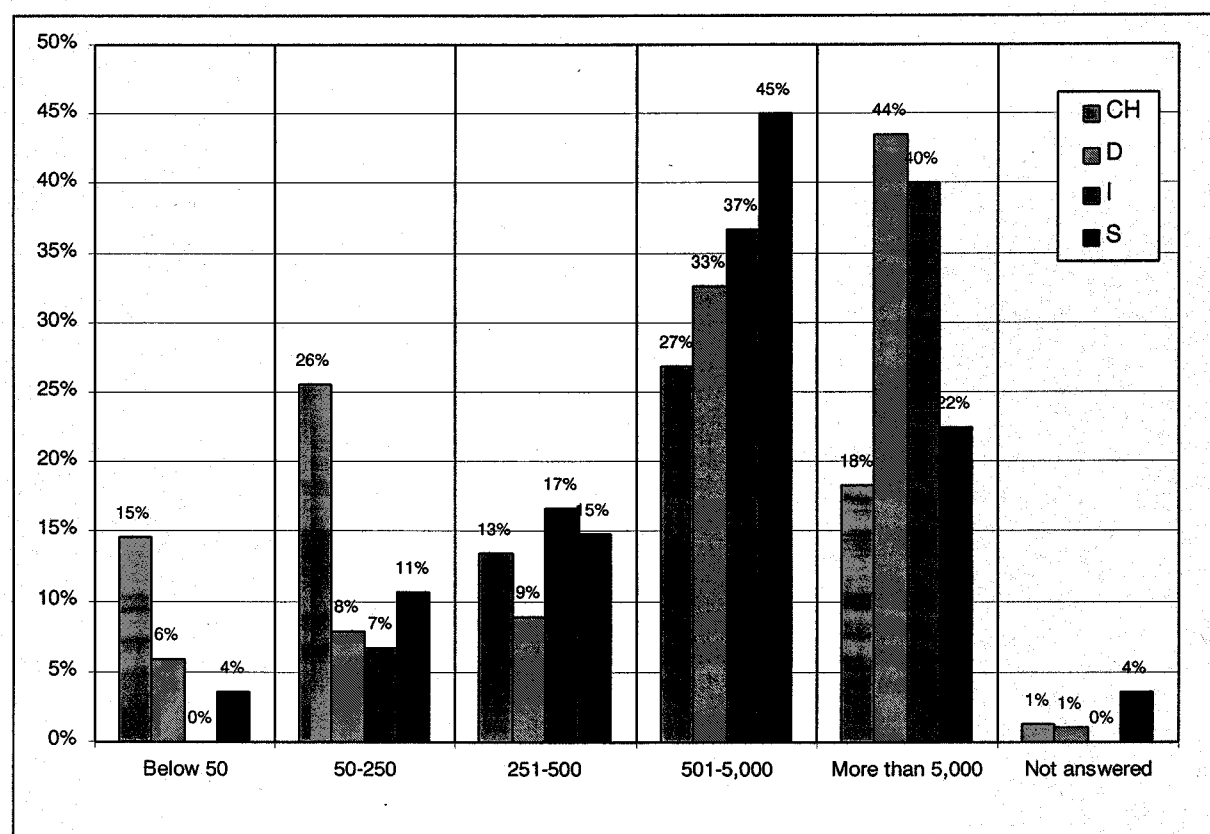


Figure 1.2: Size of the answering companies in the four countries (relative shares in % of respondents in each country)

2 Motivation and LCA

In this chapter, we report on motivations for starting LCA's within companies. Environmental concerns (see section 2.1), the relationship between the application of LCA and EMAS (see section 2.2), the importance of different stakeholders (see section 2.3) and the drivers for starting LCA's (see section 2.4) are described.

2.1 Environmental concerns and LCA

The companies were asked for their ranking of different environmental concerns⁹, namely process-related concerns (water discharge, waste, air emission, noise, energy consumption), supplier-related concerns (environmental performance) and concerns related to the use and disposal of products. A ranking among five stages was offered. The results were divided into companies using LCA and companies not using LCA:

- In **Switzerland**, LCA-applying companies have a stronger perception of environmental problems than companies not using LCA. Process-related and use/disposal-related concerns are ranked nearly identically.
- In **Germany**, LCA-applying companies have a stronger awareness of environmental problems

⁹ One answer for each concern was allowed.

than companies not using LCA's. In addition, there is usually a hierarchy in focus: first process-, then supplier- and finally use- and disposal-related concerns.

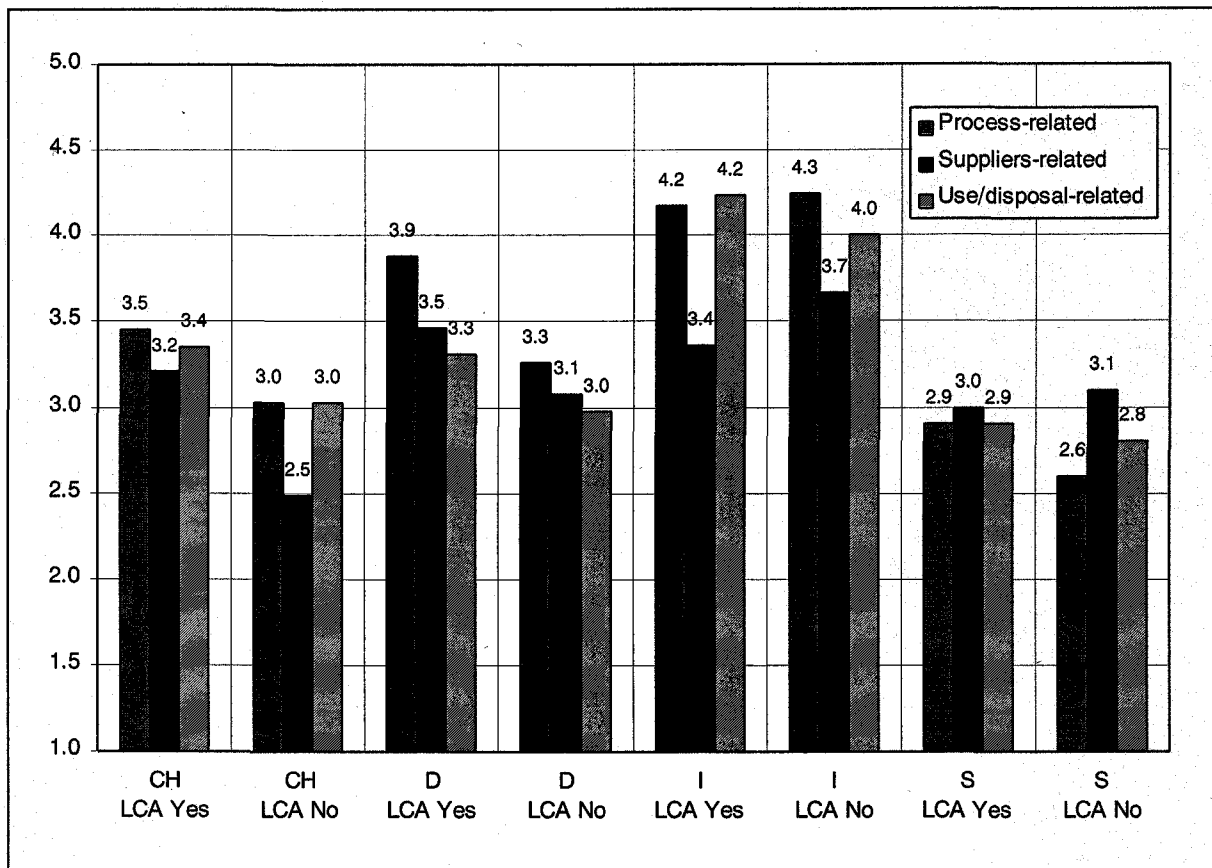


Figure 2.1: Environmental concerns of LCA-using companies and those not using LCA - relative importance [excluding refusals]

- In **Italy**, environmental concerns in nearly all cases are ranked higher than in the other countries. This may be an expression of the Italian „culture“ of drama and action. In general, the differences between LCA users and non-LCA users are not important. One can conclude that environmental concerns have nothing to do with LCA. The process- and use/disposal-related environmental concerns are of the highest rank.
- In **Sweden**, the LCA companies in general rank the importance of environmental concerns slightly higher than non-LCA companies. The largest difference is that LCA companies rank their own process to have larger importance than non-LCA companies. It is not possible to tell if this is the reason for doing LCAs or if the awareness of the process importance come from the use of LCA. However, LCA-companies rank all three environmental concerns nearly the same.

With the exception of the Italian results, LCA-companies - in general - have a stronger perception of environmental concerns than companies not using LCA. However, the difference between the two groups is quite small. From this fact, one might conclude that environmental consciousness seems to be a necessary but not sufficient condition for LCA. Generally, process-related environmental issues are ranked higher than the other issues; however, the hierarchy differs among the four countries.

The differences in the absolute rankings among the countries are likely based on the specific national

culture and should be treated very carefully and not be overinterpreted.

2.2 Environmental management systems and LCA

Companies were asked whether they have already implemented or plan to have an Environmental Management System (as defined by EMAS, BS 7750, ISO 14000) or not¹⁰. In the evaluation, we combined the answers of the companies already using an environmental management system and those planning to use one. The results were split into companies using LCA and those not using LCA:

- **Switzerland:** The majority of the companies participating in the survey indicated that they already used or planned to use an environmental management system. However, those companies stating not to use LCA used this system more often than the LCA-using-companies. This might be interpreted as a more negative connection between environmental management system and LCA.

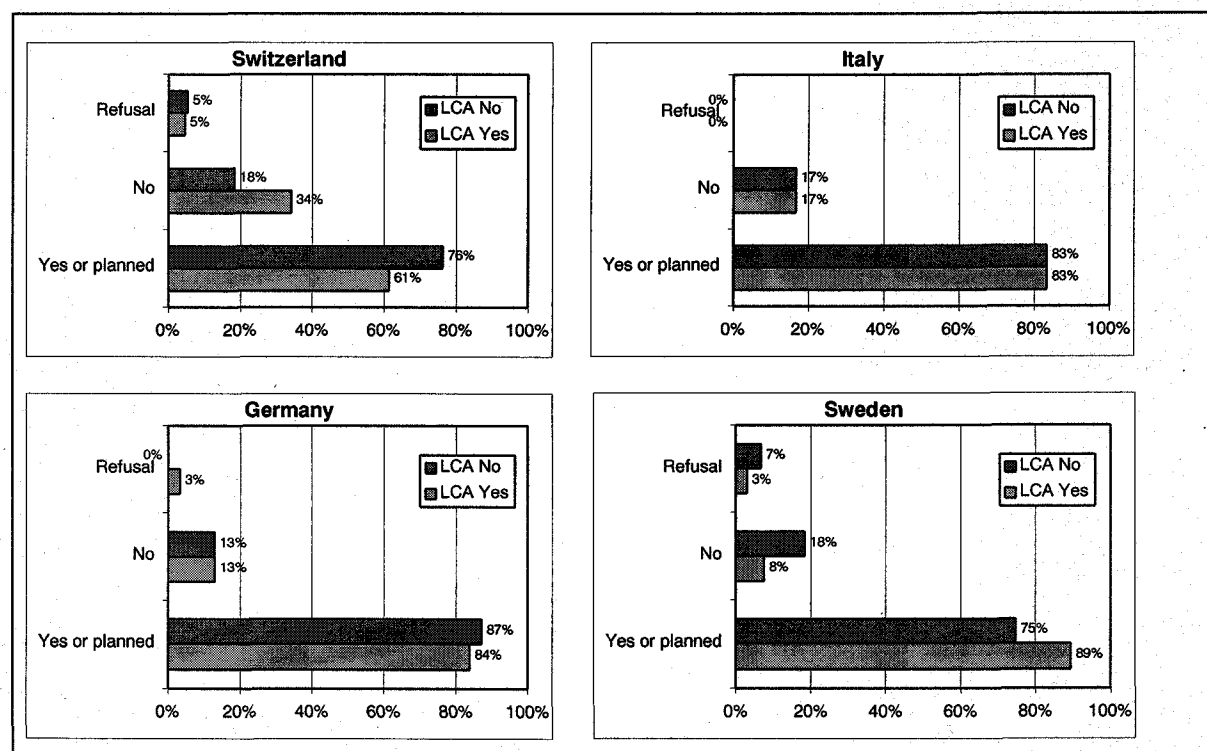


Figure 2.2: Environmental management systems and LCA (relative shares respectively in % of responding LCA-using and non-LCA using companies in each country)¹¹

- **Germany:** Most of the companies participating in the survey indicated that they had or planned to introduce an environmental management system. The differences between both groups are very small.
- **Italy:** The Italian situation is nearly the same as the German; most companies participating in the survey indicated that they already had or planned to introduce an environmental management system. The differences between both groups are very small.

¹⁰ One possible answer for each management system.

¹¹ It is worth remembering the numbers of LCA users as share of respondents in each country: CH: 54%, D: 61%; I: 60%; S: 39%

- **Sweden:** Nearly all companies using already LCA had or planned to introduce an environmental management system. There seems to be a strong positive connection between environmental management systems and the application of LCA.

The general tendency seems to be that most responding companies are very active in the field of environmental management. Of course, this statement is also due to the selection of companies (see section 1.1). However, the fact that a large percentage of companies non using LCA have or plan to have an EMS might bring to the conclusion that the existence of an environmental management system seems to be a necessary, but not sufficient condition for an LCA; in the case of Sweden, the positive relationship seems to be stronger.

2.3 Importance of stakeholders and LCA

Stakeholders influence companies and their decisions and actions. We asked for the importance of 11 different stakeholder groups according to a five step scale¹³. We also introduced a distinction between the current importance and the expected future importance¹⁴. The results were divided into companies using LCA and companies not using LCA (see Figures 2.3).

- **Switzerland:** Business clients and final consumers (i.e. the market) as well as regulators (i.e. the policy) are the most important *current* stakeholders for both groups of companies. Trade unions, local communities and suppliers are the less important ones. Companies using LCA tend to rank all stakeholders higher than companies of the other group; a stronger pressure is supposed to perceive from especially environmental/consumer groups but also from regulators and the market.

The future influence of the different stakeholders is generally rated higher than the current influence.

¹³ One answer for each stakeholder was allowed.

¹⁴ Within five years.

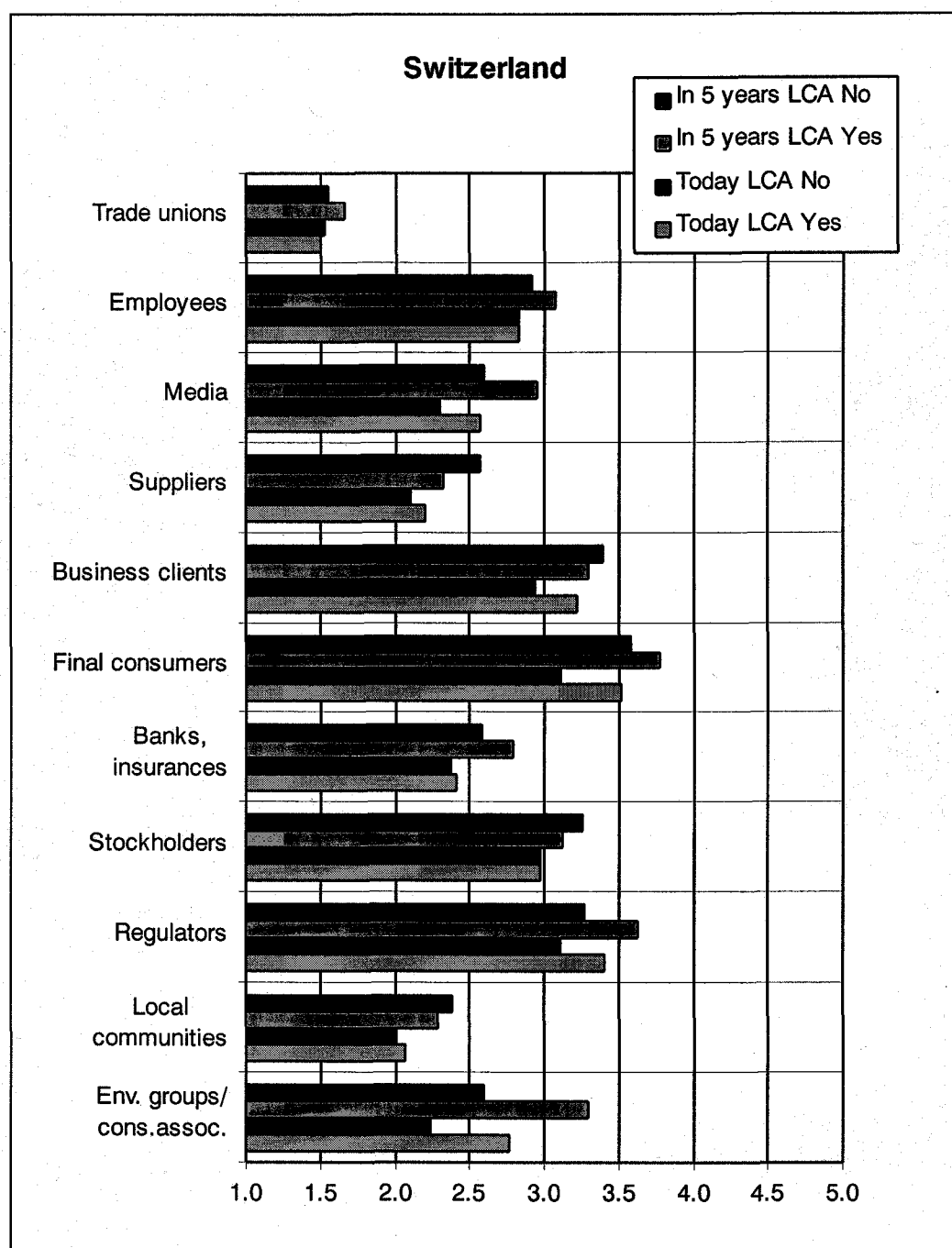


Figure 2.3: Current and future influences of different stakeholders in Switzerland (relative importance - weighted mean ranking values, without refusals¹⁴)

- **Germany:** Here as well, policy-makers and the market are the most important *current* stakeholders influencing both groups of companies. The less important stakeholders are trade unions, local communities and banks/insurances.

The *future* influence of different stakeholders is generally also ranked higher by companies using LCA than by companies not using it.

In general, companies using LCA rank stakeholders higher than other companies. A remarkable difference exists in the case of environmental and consumer groups and banks. Altogether the

¹⁴ See section 1.3 for a detailed description of the calculation method.

market and politics exert the greatest influence on both groups of companies.

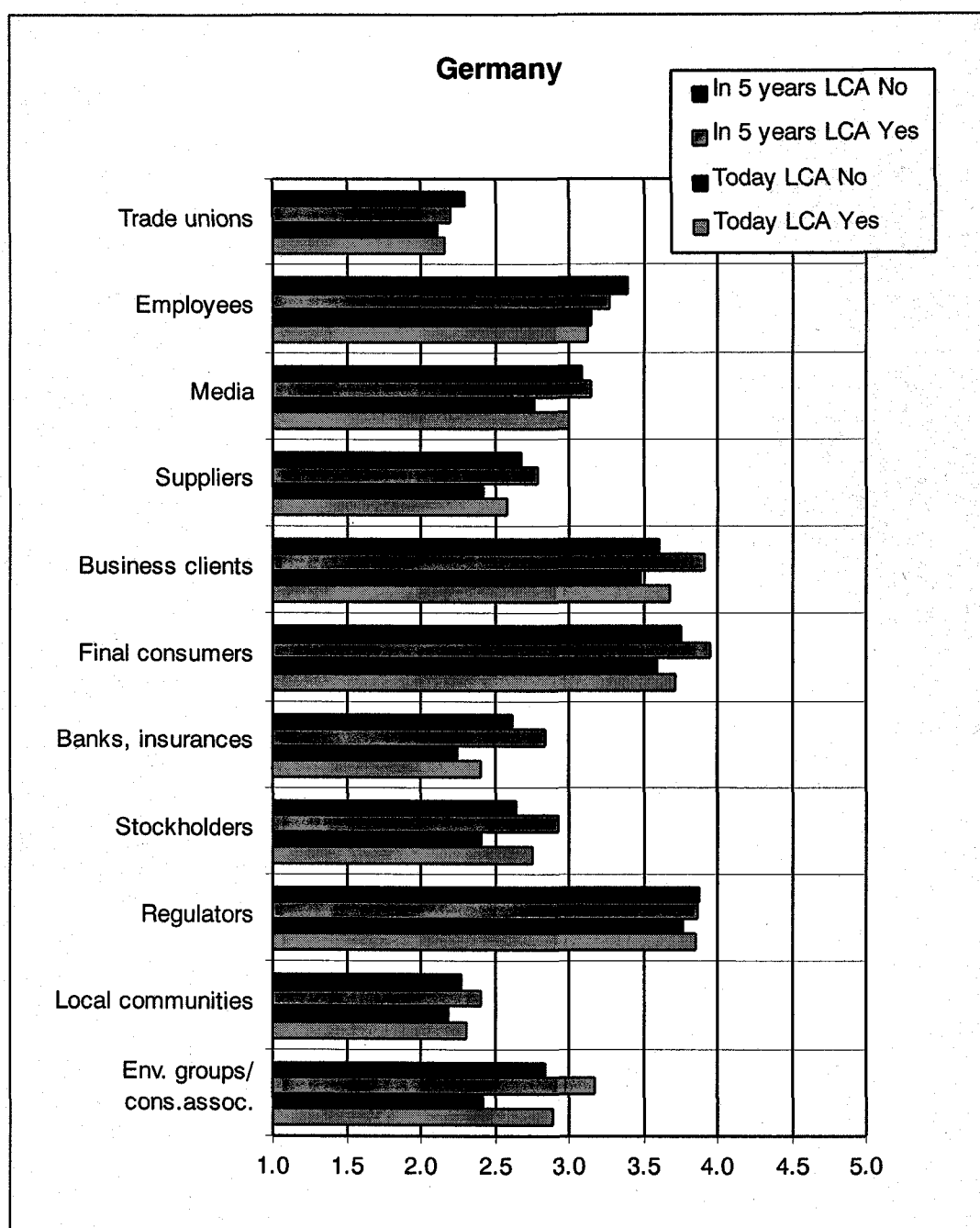


Figure 2.4: Current and future influences of different stakeholders in Germany (relative importance - weighted mean ranking values, without refusals)

- **Italy¹⁵** : The most important present stakeholders for both groups are the market and the stockholders (i.e. owner, capital). Banks/insurances and NGO's have a restricted importance as stakeholders. Also local communities are ranked high by LCA-companies, especially for the future.

¹⁵ Due to the specific national situation, the Italian questionnaire did not ask for media, suppliers and regulators as stakeholders. However, by general knowledge and from the case-studies carried out within the whole research project, it is known that at present these three groups are not main motivation factors for starting LCA activities in Italian companies. The importance of regulators is expected to increase in the future.

For the future, nearly all stakeholders are ranked higher.

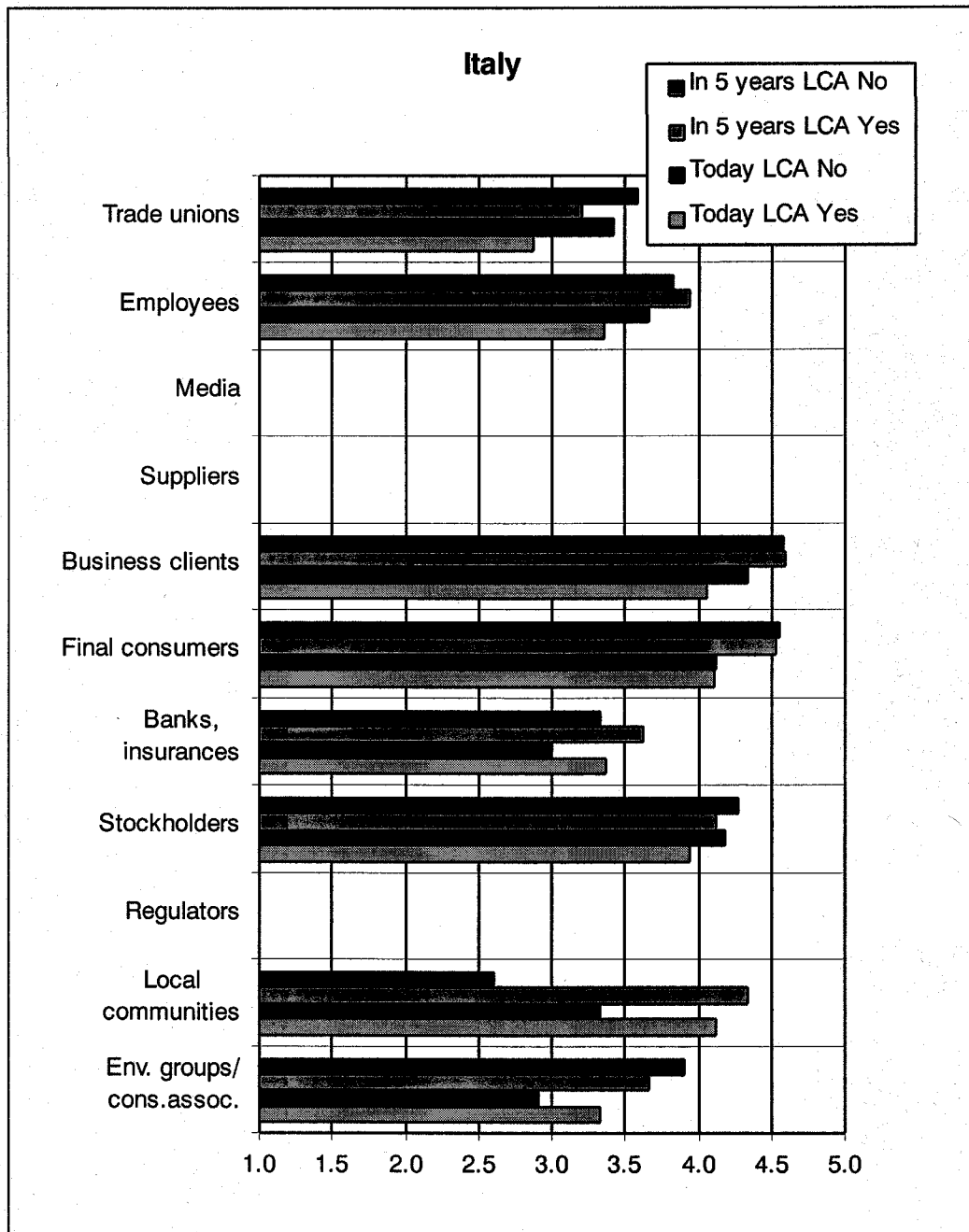


Figure 2.5: Current and future influences of different stakeholders in Italy (relative importance - weighted mean ranking values, without refusals)

- Sweden:** Market and politics are the most important current stakeholders for both groups of companies; however employees are considered to be an important stakeholder by companies indicating not to use LCA. The LCA companies particularly perceive the pressure exerted by final consumers, environmental groups and media as more important than non-LCA companies. The non-LCA companies on the other hand rank local communities and stockholders higher than the LCA companies. In general, companies using LCA perceive external stakeholders stronger than companies which do not use LCA.

The future influence of the various stakeholders is ranked in most cases very similarly to their

present influence. However the importance of banks/insurances is supposed to become more important.

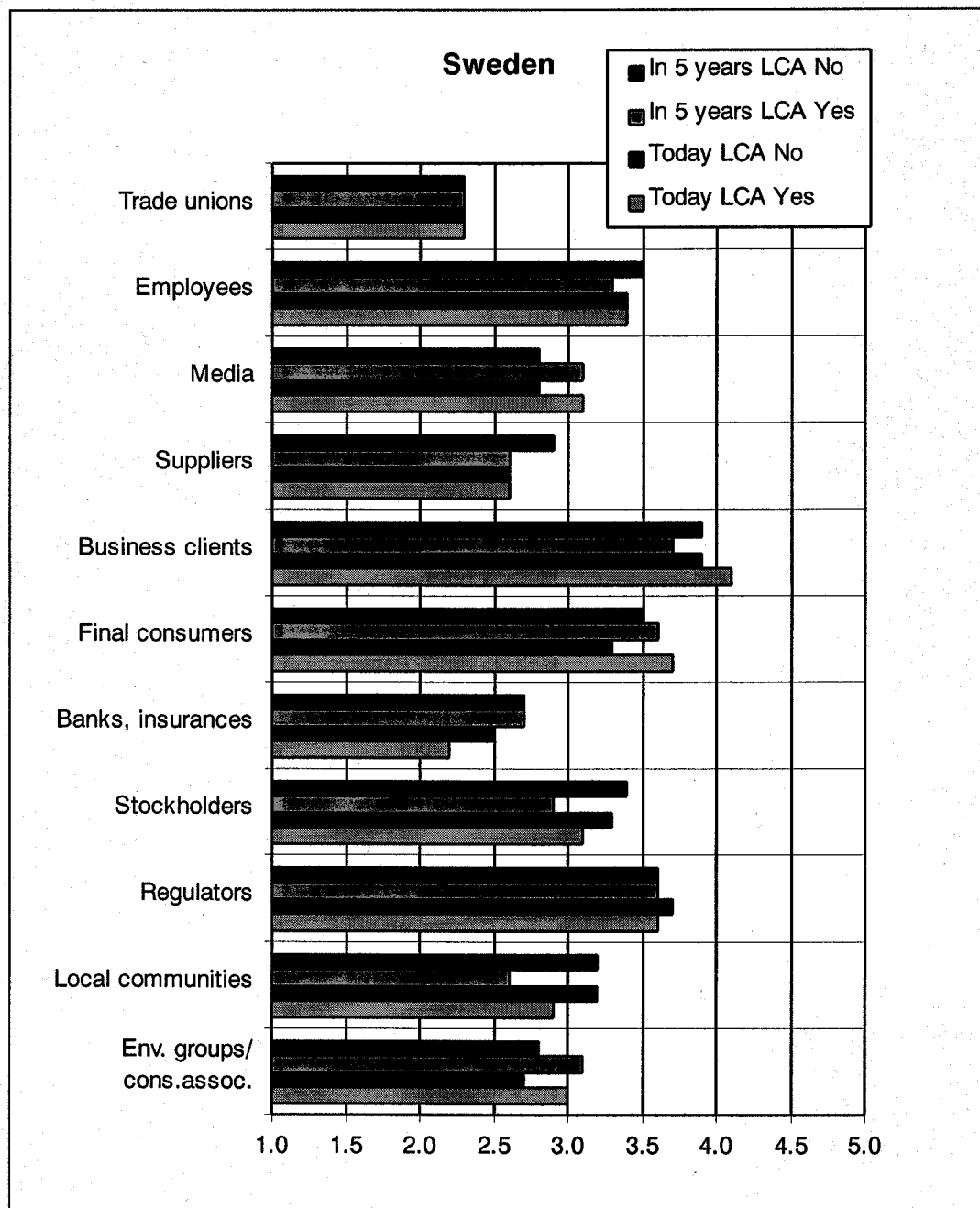


Figure 2.6: Current and future influences of different stakeholders in Sweden (relative importance - weighted mean ranking values, without refusals)

The relative importance of the different stakeholders according to a ranking list is presented in Table 2.1 for the group of companies using LCA and in Table 2.2 for the group of companies which indicated not to use LCA. The general tendencies are:

- **LCA-users:** Final consumers, business clients and regulators are the most important stakeholders today and in the future. Trade unions are perceived as of no importance in this context. Environmental groups/consumer organisations, employees, stockholders, media are stakeholders of medium importance except of Switzerland where they are ranked higher in the future. No clear

tendency exists for local communities, suppliers and - a little bit surprising - for banks/insurances.

- **Non-LCA-users:** Regulators and - in most cases - final consumers and business clients are the most important stakeholders. However for Swedish companies employees play an important role as present stakeholders. The role of stockholders in the four countries is different: in Switzerland and also Italy, they are at the top of the list whereas their importance is minor in Germany and Sweden. Media, employees, environmental groups/consumer associations are of medium importance. Trade unions are perceived as being of little importance - except in the Italian case.

Table 2.1: Relative importance of different stakeholders for companies using LCA in the four countries (relative ranking)¹⁶

Stakeholders	CH		D		I		S	
	today	future	today	future	today	future	today	future
Final consumers								
Business clients						A		
Regulators					n.a.	n.a.	A	
Environmental groups/ consumer associations	B		B	B	C	B	B	B
Media	B	B	B	B	n.a.	n.a.	B	B
Employees	B	B	B	B	B	B	B	B
Stockholders	B	B	B	B	B	B	B	B
Local communities	C	C	C	C		B	B	C
Banks, insurances	B	B	C	C	B	C	C	B
Suppliers	C	C	B	C	n.a.	n.a.	C	C
Trade unions	C	C	C	C	C	C	C	C

Explanation: A = high importance
 B = medium importance
 C = low importance
 n.a. = not available

¹⁶ The method of ranking into A-B-C is described in section 1.3. As already mentioned, the Italian questionnaire did not ask for regulators, media and suppliers as stakeholders.

Table 2.2: Relative importance of different stakeholders for companies not using LCA in the four countries (relative ranking)¹⁷

Stakeholders	CH		D		I		S	
	Today	Future	Today	Future	Today	Future	Today	Future
Regulators					n.a.	n.a.	A	A
Business clients	B							A
Final consumers					B		B	A
Stockholders			B	C		B	B	B
Employees	B	B	B	B	B	B	A	A
Media	B	C	B	B	n.a.	n.a.	B	C
Suppliers	C	C	B	B	n.a.	n.a.	C	B
Environmental groups/ consumer associations	B	C	B	B	C	B	B	C
Local communities	C	C	C	C	B	C	B	B
Trade unions	C	C	C	C	B	B	C	C
Banks, insurances	B	C	C	C	C	C	C	C

Explanation: A = high importance
 B = medium importance
 C = low importance
 n.a. = not available

Comparing LCA users and non-users (see Figures 2.7 and 2.8), it becomes clear that the tendencies are similar, but some differences do exist¹⁸:

- **Present importance of stakeholders:** German and Swiss LCA-using companies rank nearly all stakeholders higher than companies which do not use LCA; this is especially valid for environmental groups/consumer associations. Italian companies rank in a different way: similarly to companies in Germany and Switzerland, Italian companies using LCA rank environmental groups and local communities higher; however, stockholders, business clients and employees are ranked higher by non-LCA companies. Swedish companies also show a different picture; NGO's, the market and media are ranked higher by companies using LCA; politics (regulators and local communities), stockholders and banks/insurances are ranked lower.

¹⁷ The method of ranking into A-B-C is described in section 1.3. As mentioned, the Italian questionnaire did not ask for regulators, media and suppliers as stakeholders. Therefore, we allocate two major stakeholders to the „A“-group and the two minor stakeholders to the „C“-group.

¹⁸ The method of constructing this index described in section 1.3.

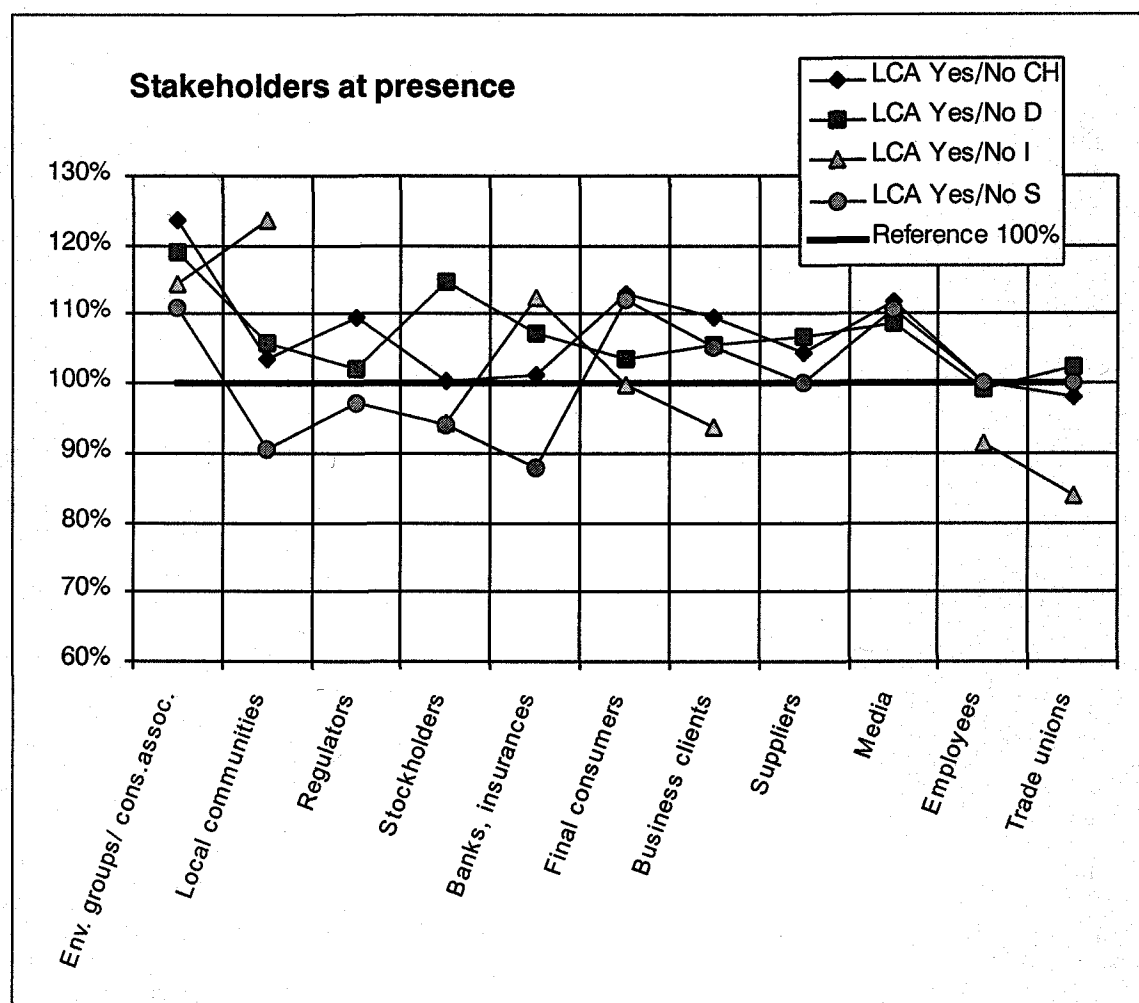


Figure 2.7: Differences in ranking of *present* stakeholders between LCA using and non-using companies (ranking weighted mean values of LCA companies divided by ranking weighted mean values of non-LCA companies - relative %)

- Future importance of stakeholders:** Altogether, the future influence of the different stakeholders is rated higher than the current influence. LCA-companies tend to rank some stakeholders higher than companies not using LCA. As in the case of present importance, German companies using LCA rank nearly all stakeholders higher than companies not using LCA. Swiss companies rank the influence especially of environmental and consumer organisations higher; also media and regulators are ranked - to a modest degree - higher. Once again, the Italian picture is characterised by huge differences: Especially local communities are of a much higher importance for LCA-using companies; for all the other stakeholders, the differences between both groups are not so important. The Swedish situation is also different because most stakeholders are not ranked higher by LCA-using companies.

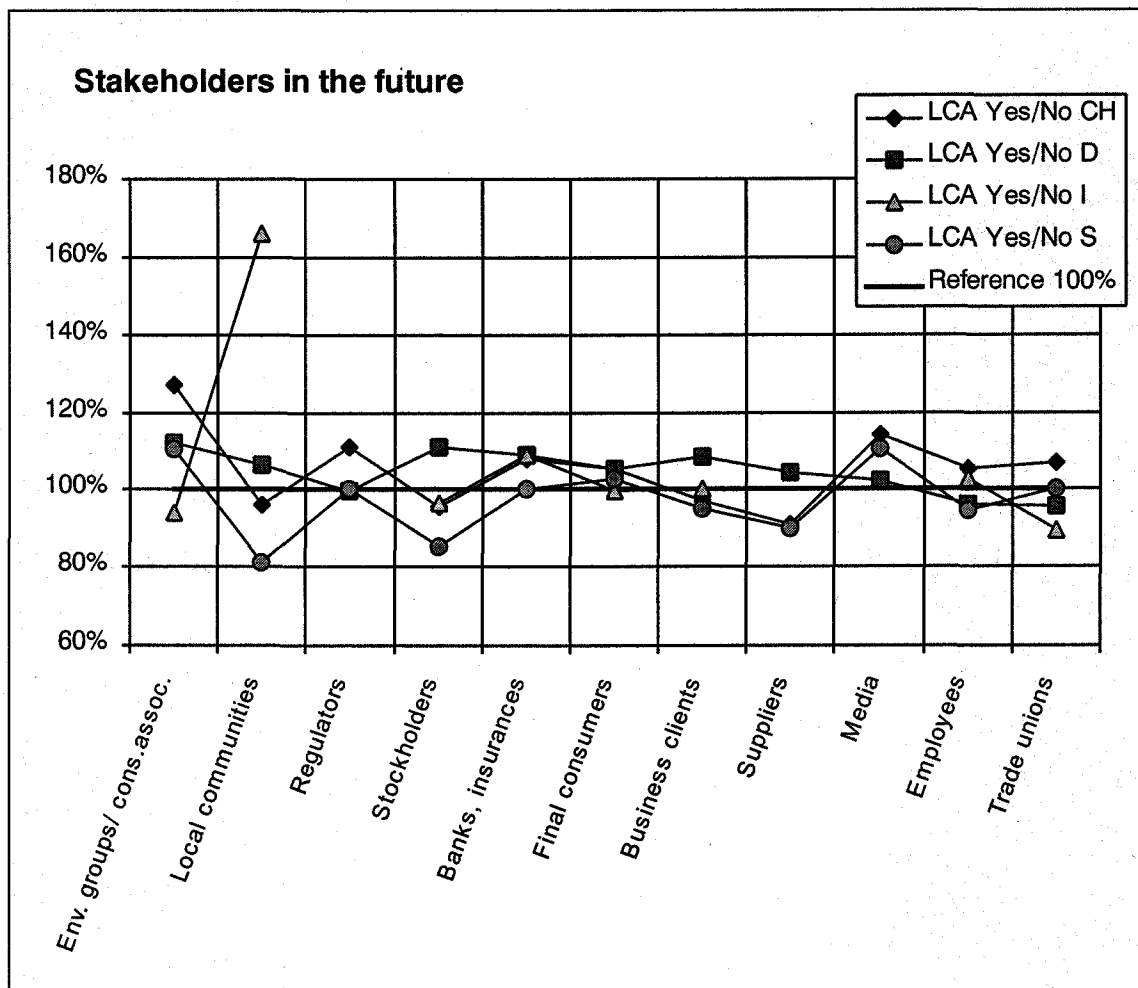


Figure 2.8: Differences in ranking of *future* stakeholders between LCA using and non-using companies (ranking weighted mean values of LCA companies divided by ranking weighted mean values of non-LCA companies - relative %)

2.4 Motivations for applying LCA

A lot of different impulses to start LCA exist¹⁹. This topic was treated by a question according to a five step scale for 13 possible drivers. Obviously, the results refer only to companies using LCA:

- **Switzerland:** product-related environmental problems, cost-saving opportunities and emerging green markets are the most important drivers. The less important ones are encouragements from parent companies, use of LCA by competitors and the will to introduce new instruments for R&D.
- **Germany:** There are a lot of pushing factors which were ranked nearly identically the same: cost-saving opportunities, product-related environmental problems, emerging green markets, participation in collaborative LCA-studies, management decisions, perceived environmental discussions. Of less importance are the use of LCA by competitors, encouragements by the parent companies and the introduction of new instruments for R&D.
- **Italy:** The most important driver for starting LCA is the encouragement by parent companies.

¹⁹ Several answers to this question were allowed.

This is due to the structure of the companies answering the questionnaire (see section 1.4): an extreme quota of multinational companies. The next important drivers are cost-saving opportunities, new instruments for Research & Development (R&D) and perceived environmental discussions. The less important drivers are collaborative studies with external organisations, competitors who started to use LCA and initiatives by R&D

- **Sweden:** Initiatives by R&D, product related environmental problems and cost avoidance are the most important drivers. Less important are the environmental legislation, the use of LCA by competitors and the use of LCA as a new instrument for R&D.

From these results, one can draw the general conclusions that the drivers are very similar in Germany and Switzerland: important are cost-savings and product-related questions (either as a perceived risk in the form of problems or as a chance to act proactive by emerging to green markets). The internal perception of external circumstances might be the most important driver to start LCA. Especially in Italy, the international context - expressed as a dependency on external co-operation - is of huge importance. Worth mentioning is the most important Swedish driver „Initiative by R&D“.

Table 2.3: Drivers for starting LCA in the four countries²⁰

Drivers	CH	D	I	S
Product-related environmental problems			B	
Cost-saving opportunities				B
Emerging green markets			B	B
Decision of the management	B		B	B
Perceived environmental discussions	B		B	B
Cost avoidance due to future liabilities	B	B	B	
Collaborative study with ext. organisations	B		C	B
Meet eco label criteria	B	B	B	B
Initiatives by Research & Development	B	B	C	A
Encouragement by the parent company	C	C		B
New Instruments for R & D	C	C		C
Environmental legislation	B	B	B	C
Competitors started to use it	C	C	C	C

Explanation: A = high importance
 B = medium importance
 C = low importance

In all four countries, a direct influence by the application of LCA by competing companies is not perceived as a driver. Environmental legislation, i.e. political or legal pressure, is not an important driver for LCA, especially in Sweden.

²⁰ The method of the ranking into A-B-C is described in section 1.3.

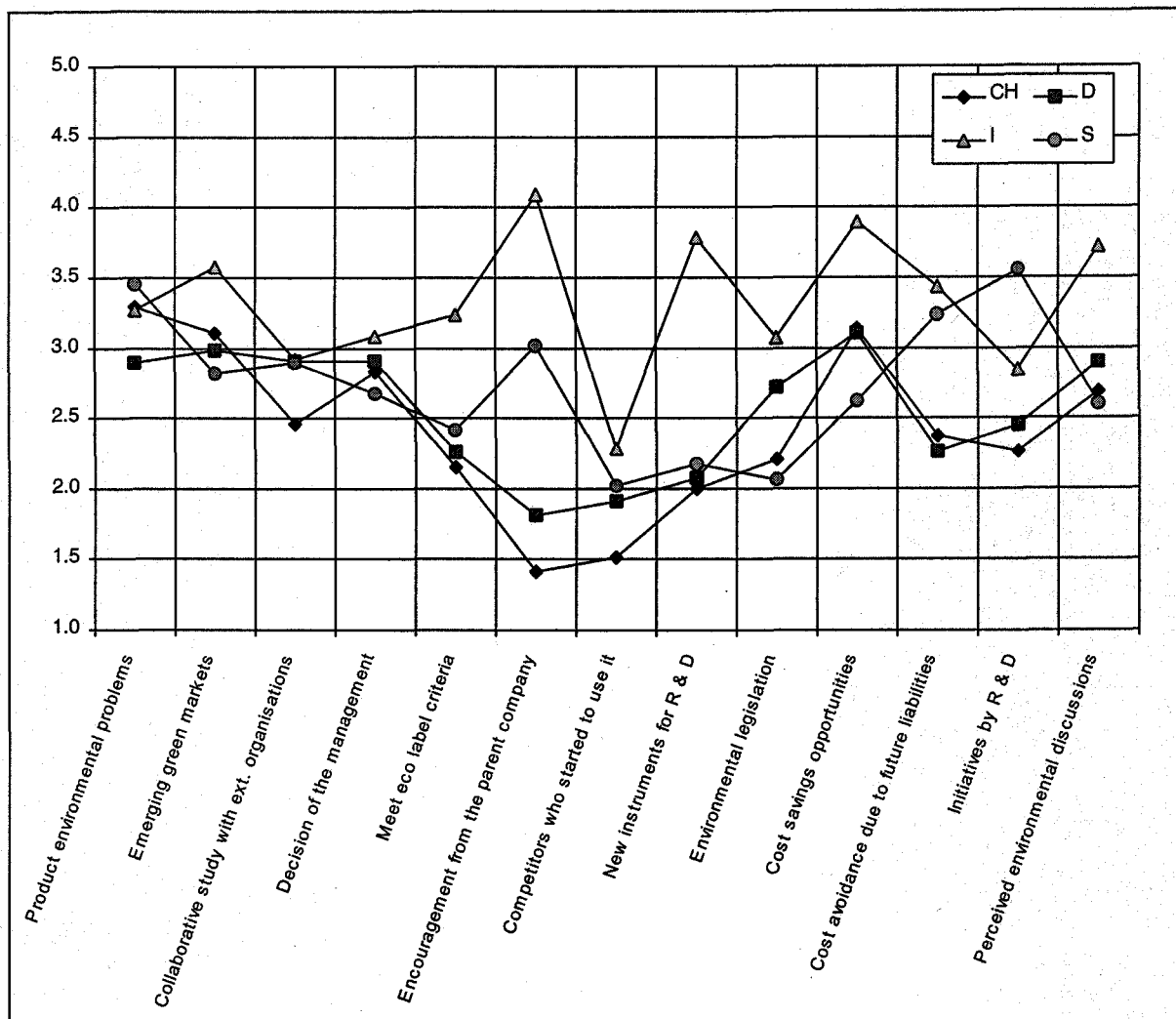


Figure 2.9: Drivers for starting LCA in the four countries (relative importance - weighted mean ranking values, without refusals)

3 Application of LCA

The results of this section refer only to LCA-using companies. This section reports on the different applications of LCA in business. It refers both to a set of different kinds of applications along the product development chain and to different kinds of products (some vs. all products, existing vs. new products, etc.). Both current (section 3.1) and expected future applications (section 3.2) are taken into account. Possible applications along the product development chain²¹ range from strategic applications (*anticipate and negotiate legislation, radical changes in the product life cycle, shift from product to service*), research, development and design, production and procurement (*bottleneck identification, procurement specifications*), marketing (*compare existing products with planned alternatives; compare existing company products with products of competitors; define marketing & advertising policies and join eco-labelling criteria, assess the gap from eco-label criteria*), environmental cost allocation up to information (*internal information and training; information and education to consumers and stakeholders*). In section 3.3, we refer to those types of products which are subjects of LCA.-studies.

²¹ For more details about this possible classification of LCA applications, please refer to [Rubik et al. 1999 - Chapter 1.3].

3.1 Current applications of LCA

Figure 3.1 shows the current applications of LCA in companies²². In order to compare the different countries, results are expressed in per cent.

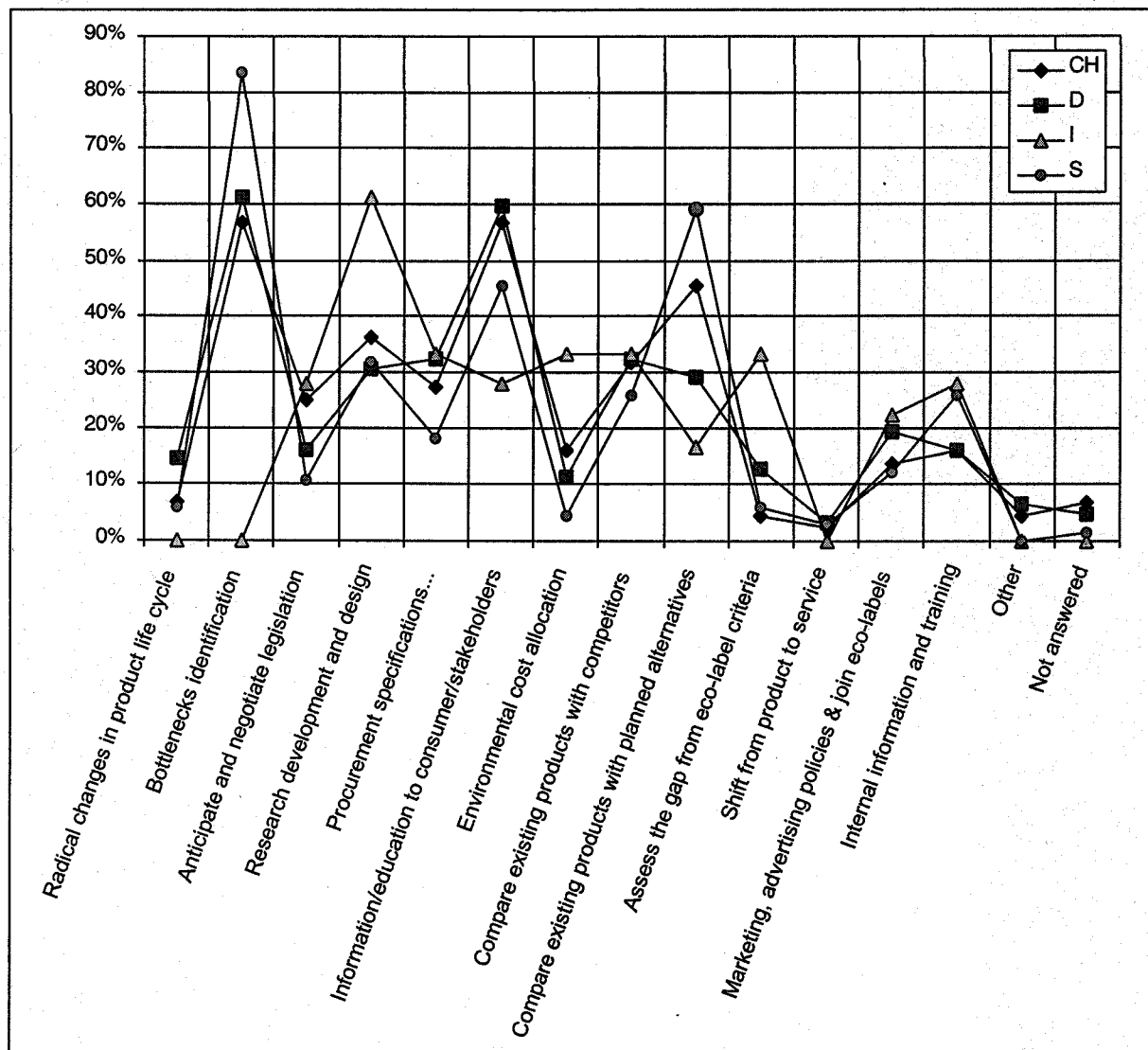


Figure 3.1: Current applications of LCA (relative preference shares in % of LCA-using companies in each country)

Figure 3.1 and Table 3.1 (see next section) highlight the main applications as well as the rarely used applications of LCA in the different countries. At present, the main results for each country are:

- Switzerland:** the ranking of the most important LCA application is equally shared by the *identification of bottlenecks* and the *information of consumers and stakeholders* (57%). The fact that 45% of companies declare to apply LCA to *compare existing products and possible alternatives* is a (modest) hint towards a relationship between product innovation and the use of LCA in Switzerland. The less important applications in this country are two „strategic“ applications, namely *radical changes in the product life cycle* and the *shift from product to service*.

²² Companies were asked to tick up to 4 choices.

- **Germany:** In Germany, the two most important applications are also the *identification of bottlenecks* and the *information of consumers and stakeholders* (61% and 60% respectively). The third ranking, however at a much lower level, is equally shared by *compare existing company products with products of competitors and procurement specifications* (32%). The application of LCA for *research development and design* is also very close to this ranking value (31%). Once again, the least important application is the *shift from product to service*. However, 15% of German LCA-companies declare to use it for *radical changes in the product life cycle*. This might (modestly) suggest that German companies tend to use LCA in a slightly more „strategic“ way than companies in other countries.
- **Italy:** Italy shows very different results²³. LCA is by far mostly conceived for internal use in companies within the framework of research, development and design (R, D&D) activities (61%). This result is highly reliable. On the contrary, a strange result is that no company at all declared to use LCA for bottleneck identification. A possible explanation of this phenomenon is that the Italian term used in the questionnaire (*“identificazione di colli di bottiglia”*) might not be common in the framework of Italian business and might have not been fully understood by the people filling in the questionnaire. There is absolutely no sign of using LCA in a „strategic“ way, as it is not used at all either for *radical changes in the product life cycle* or for *shift from product to service*.
- **Sweden:** The *identification of bottlenecks* is by far the most important application in Sweden (83%). There is also a rather clear tendency towards a more prospective use of LCA, since 59% of the companies use LCA to *compare existing products with possible alternatives*. LCA is also used for external information (*Information and education to consumers and stakeholders* – 45%). R, D&D follows with 31%. The less used applications are again *radical changes in the product life cycle* and *shift from product to service*, followed by *environmental cost allocation*.

Summarising, a quite common trend in Switzerland, Germany and Sweden exists, whereas Italy shows very different results. In the three former countries the identification of bottlenecks is the most important application of LCA (with a very high peak in Sweden). This application seems to be absolutely irrelevant in Italy²⁴. Another common application in the three countries is the external information of consumers and stakeholders. Once again, there is a big difference in Italy. This reflects the fact that in Italy people mostly think that LCA results are still too complicate to be communicated to the public. This might be connected with the fact that LCA in Italy is still rather at an early stage of development. As a matter of fact, a more „external“ use of LCA results is expected in the future (see next paragraph).

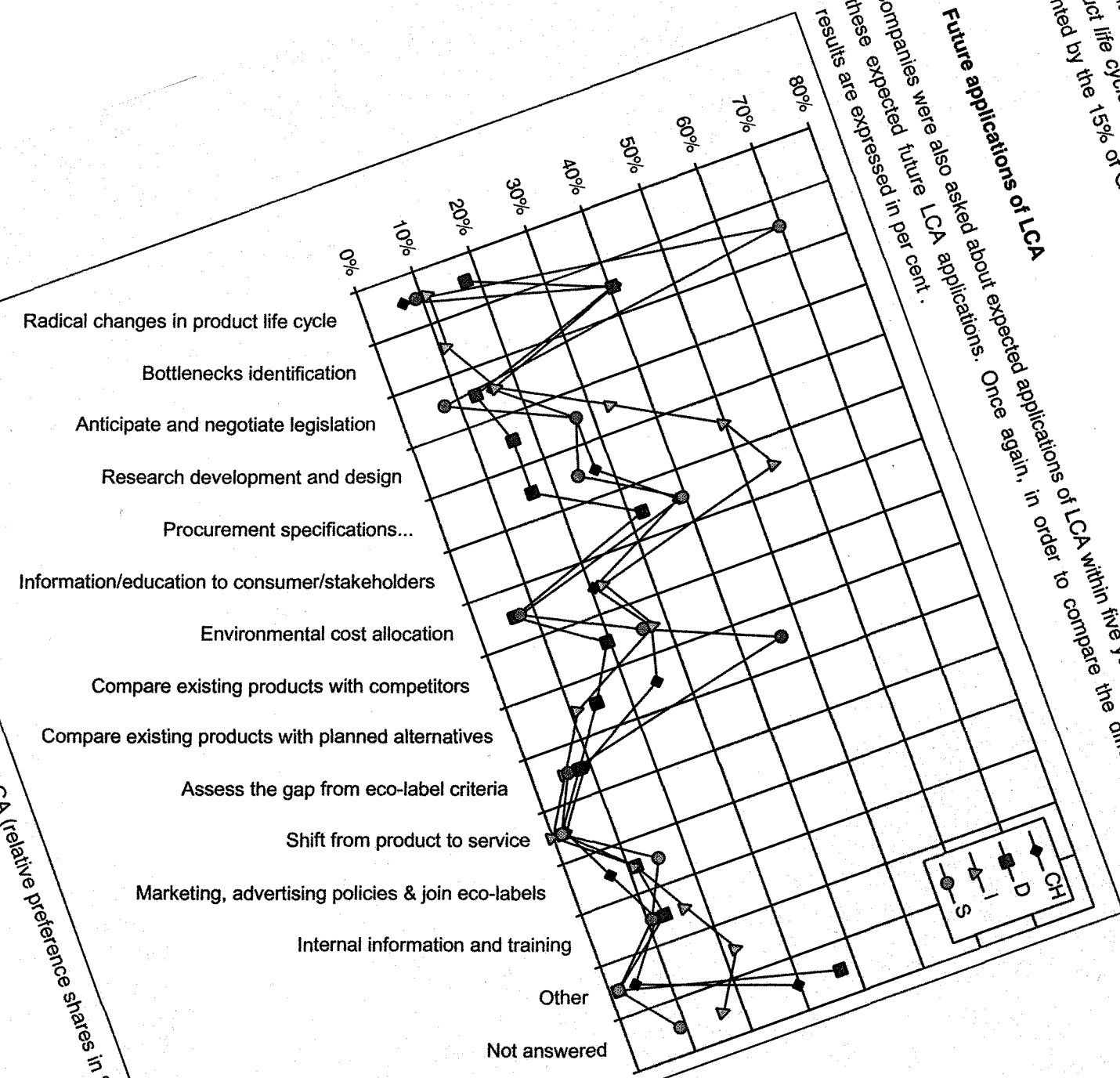
The application for the purpose of a comparison between existing products and possible alternatives suggests a more proactive use of LCA in Switzerland and Sweden (see also section 3.3). This application is much less relevant in Germany (29%) and is very rare in Italy (17%). On the other hand, Germany and Italy seem to be quite susceptible to pressure from outside (Compare existing company products with products of competitors; Procurement specifications...; Assess the gap from eco-label criteria, etc.). Finally, LCA is used in all countries as a tool for research, development & design. This is the main application in Italy, where LCA is still mostly regarded as an internal tool. However in the other countries, more than 30% of the companies also use LCA for this particular application.

²³ „Absolute“ Italian results, however, must be interpreted carefully, reminding that only 18 companies responded to use LCA. Moreover, 9 of these ticked only 3 choices, 2 companies two choices and 1 company 1 choice only.

²⁴ However, the question could have been misinterpreted.

25 Up to four answers to this question were allowed.

Figure 3.2: Expected future applications of LCA (relative preference shares in % of LCA-using companies in each country)



Companies were also asked about expected applications of LCA within five years. Figure 3.2 shows these expected future LCA applications. Once again, in order to compare the different countries, results are expressed in per cent.

3.2 Future applications of LCA

In all countries, LCA seems not to be used for the two "strategic" applications, i.e. radical changes in the product life cycle and shift from product to service. The only (modesty) exception to this pattern is represented by the 15% of German LCA companies using LCA for radical changes in the product life cycle.

Application patterns

Figure 3.2 shows

The following main changes can be identified with respect to current applications. The three main application areas (the first two in Switzerland) remain the same in Switzerland, Germany, and Sweden. In Switzerland, an increased application for *R, D&D*, for a *comparison with products of competitors* and for *procurement specifications* are expected. In Germany, the order of qualitative ranking is almost the same as at present (only *procurement specifications* lose importance). Percentage values are lower than today, but this is mainly due to a high rate of refusals²⁶.

In Italy there is a major shift towards more external applications, namely *information and education of consumers and stakeholders* (56%), and *procurement specifications, supplier screening, product co-makership* (50%). Anyway, the use of *LCA* as a more internal tool for *R, D&D* remains important (33%). In Sweden, there is practically no change between the choice of current vs. future applications. Only *anticipate and negotiate legislation and environmental cost allocation* are ranked slightly lower than today.

Table 3.1: Qualitative ranking of present and future applications

Application	CH		D		I		S	
	today	future	today	future	today	future	today	future
Information and education to consumers and stakeholders					B			
Bottleneck identification					C	B		
Compare existing company products with products of competitors	B					B	B	B
Procurement specifications...	B			B			B	B
Compare existing products with planned alternatives		B	B	B	B	B	A	A
Research development and design	B		B	B			B	B
Internal information and training	B	B	B	B	B	B	B	B
Anticipate and negotiate legislation	B	B	B	B	B	B	B	C
Marketing, advertising policies & join eco-labelling criteria	B	C	B	B		B	B	B
Environmental cost allocation	B	B	C	C		B	B	C
Assess the gap from eco-label criteria	C	B	C	C	B	C	C	C
Radical changes in product life cycle	C	C	B	B	C	B	C	B
Shift from product to service	C	C	C	C	C	C	C	C
Other	4.5%	4.5%	6.5%	1.6%	0%	2.2%	0%	1.5%
Not answered	6.8%	29.5	4.8%	7.1%	0%	6.7%	1.5%	9.1%

Explanation: A = high importance
 B = medium importance
 C = low importance

²⁶ This affects mainly absolute per cent values. However, the results in relative terms between different applications in each country are much more reliable.

In all countries, there is a significant increase of not answering companies.

Moreover, the application for *radical changes in the product life-cycle* shows a higher (although still modest) interest than today. This gives a modest hint towards a more strategic use of LCA in the future. Finally, one must observe, that the application *assess the gap from eco-label criteria* is very rated in every country. This might be explained by the fact that national eco-label procedures do not necessarily require an LCA, and that the EU eco-label is still not known/applied.

Table 3.1 summarises both current and future application patterns for LCA in the different countries.

3.3 Kinds of products subject to LCA study

In order to identify whether companies use LCA in a rather retrospective or more prospective way, firms were asked which kinds of products they have analysed with LCA²⁷. Figure 3.3 shows the products being subject to LCA studies in the various countries. Once again, in order to compare the different countries, the results are expressed in per cent.

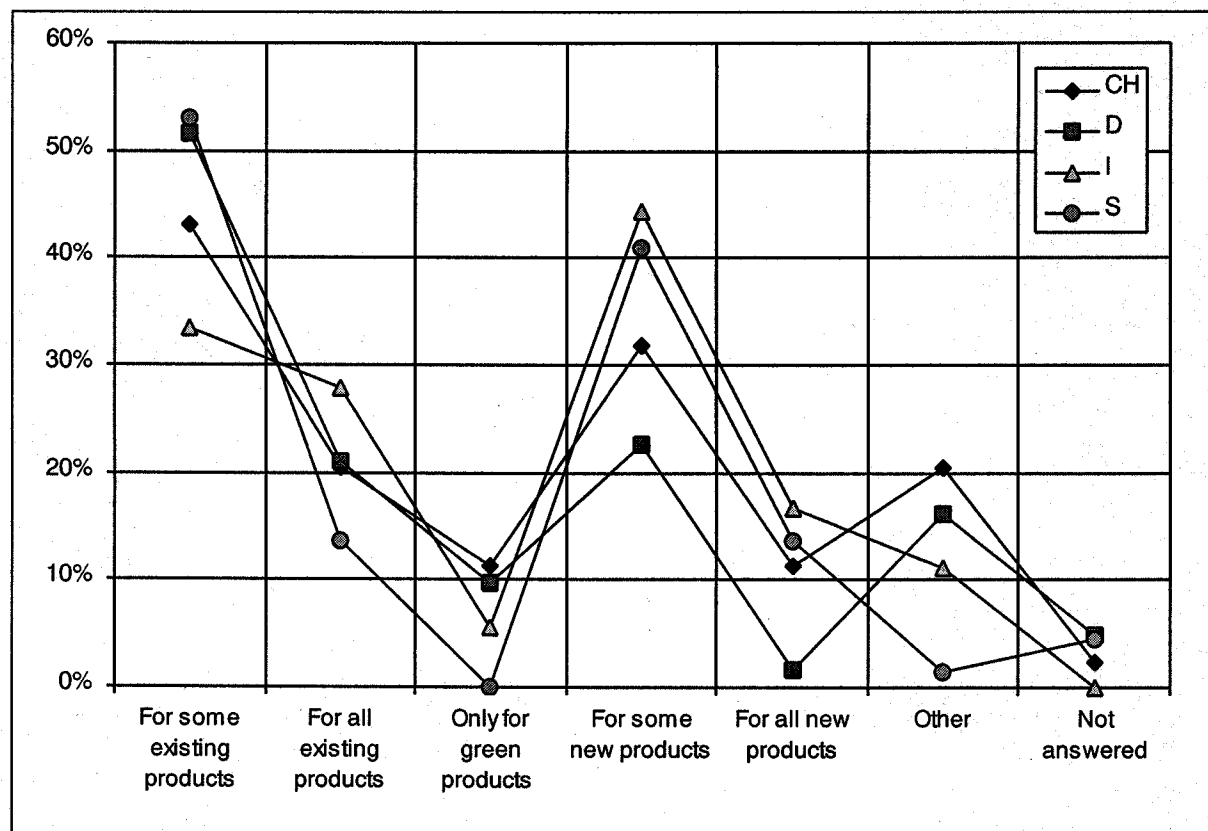


Figure 3.3: Products subject to LCA studies (relative shares in % of LCA-using companies in each country)

A common trend for all countries can easily be seen. LCA is generally applied to some products and not to all products. Moreover, LCA is mostly used for a few *existing* products, and is clearly *not* used for green products only. In general, LCA is still more frequently used in a retrospective way than in a prospective one, since it is applied more to existing products than to new products.

²⁷ Up to two answers were allowed.

In particular, the percentage of LCA application to all new products is low. All this suggests that LCA is by far not yet used as a routine tool for product innovation, and environmental product innovation in particular. This seems to be especially true in Germany, where only very few companies apply LCA to all new products, and 23% apply it to some new products. This seems slightly surprising, given the 29% of LCA-companies applying it for *comparison between existing products and possible alternatives* (29% - see section 3.1.). On the contrary, the higher percentage of Swiss and Swedish companies applying LCA to all new products and some new products is consistent with the higher rankings in section 3.1. This hints at a slightly more proactive use of LCA in those countries. The Italian results are not consistent with the previous ranking ones and do not seem to be highly reliable because of the low absolute number of respondents (all of the 18 LCA-companies responded, but 9 identified only one preference).

Moreover, all these considerations have to be considered with some care, because the application of LCA to all or to new products also strongly depends on the size and on the branch sector of the company (i.e. a small company can have a little set of products, while a big chemical company might have thousands of different products).

4 Techniques

This part reports on the „technique“ of carrying out an LCA and interpreting/applying its results. Of course, it refers only to the group of LCA-using companies. In section 4.1, we inform of the functions/departments involved in LCA-studies. The following section 4.2 presents information on the performers of LCA.

4.1 Functions involved

Figure 4.1 shows the company functions involved in LCA studies. The participation of several company functions is possible²⁸. In order to compare the different countries, the results are expressed in per cent.

The set of functions involved in LCA is quite similar in all countries. The most involved officers/departments in all cases are the environmental department (67%-82%) and R&D (36%-58%). Top management follows with the big exception of Sweden. This might be explained by the fact that Sweden is the country in which LCA is most developed and used²⁹.

Consistently with other results, in Italy LCA is used more within R&D activities and much less for marketing (see also section 3.1, 4.3 and 5.1)³⁰. On the other hand, health and safety officers are significantly more involved than in other countries. This is very likely caused by the organisation structure of Italian companies (see also section 6.3).

²⁸ Several answers to this question were allowed.

²⁹ The absolute numbers of companies answering the questionnaire and using LCA are quite similar in Sweden and Germany (respectively 66 and 62). However, if the difference of population and GNP is taken into account, it might well be concluded that Swedish companies are by far the most significant users of LCA among the four selected countries.

³⁰ By mistake, the purchasing department has not been included in the Italian translation of the questionnaire. This result has therefore not to be taken into account

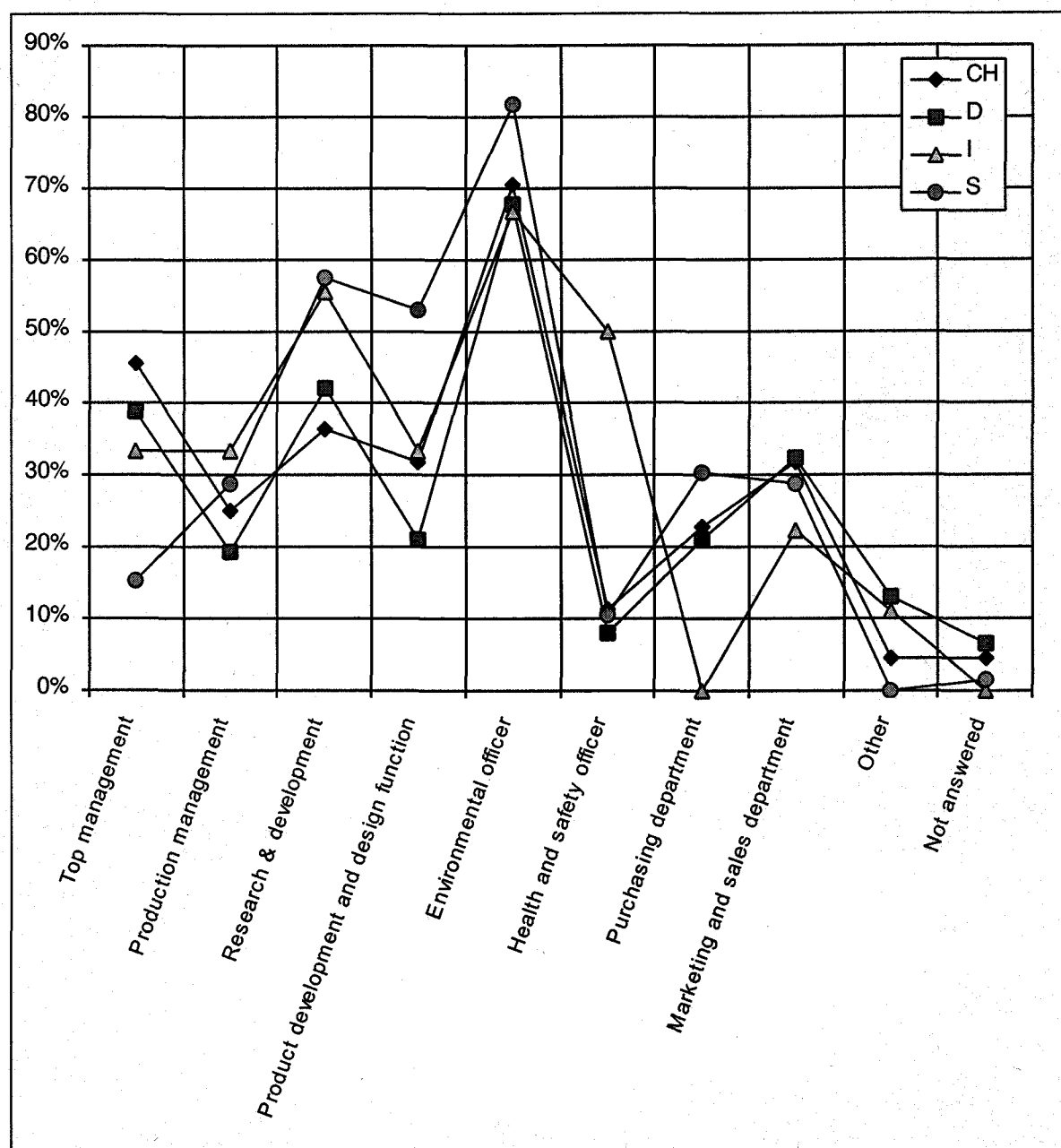


Figure 4.1: Functions involved in LCA (relative shares in % of LCA-using companies in each country)

4.2 Performers of LCA's

Companies were asked to identify the performers of LCA studies³¹. Figure 4.2 shows the percentage of LCA studies carried out by in-company teams vs. those performed by external consultants/research institutes or in collaboration with industrial associations.

³¹ Several answers were allowed.

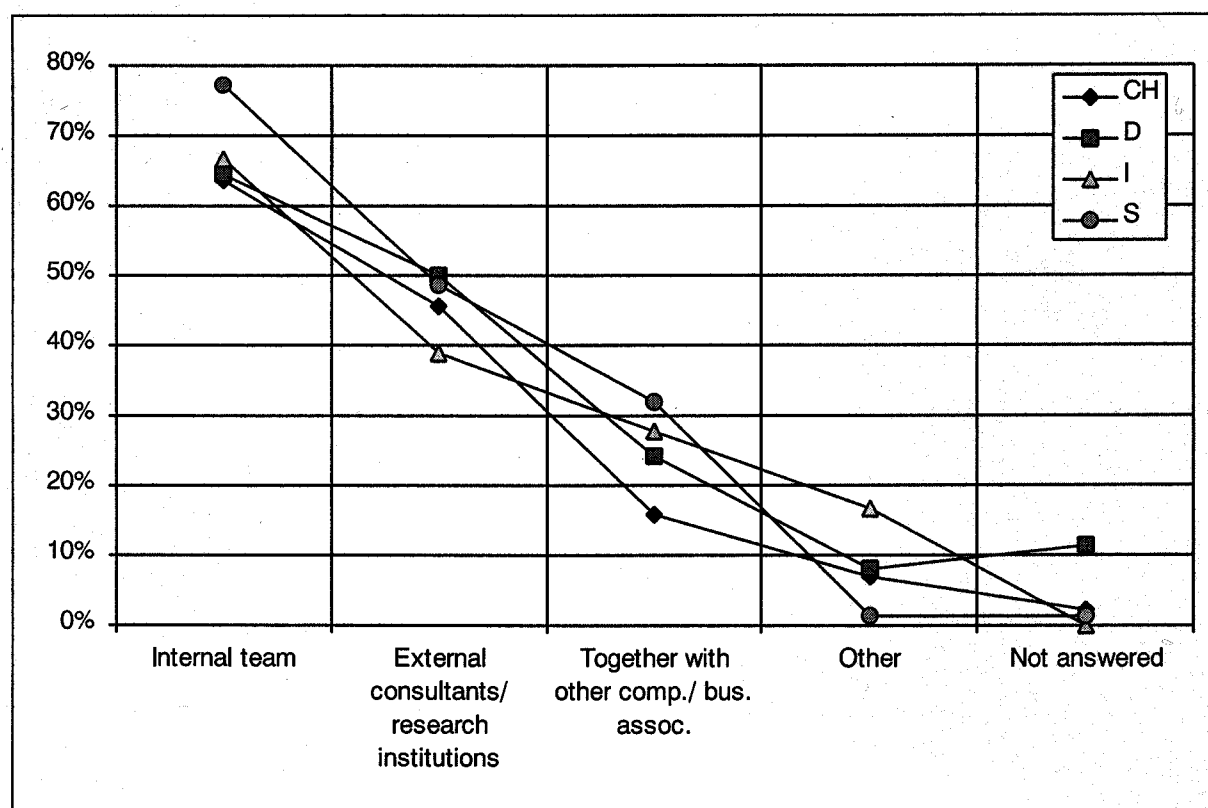


Figure 4.2: Performers of LCA studies (relative shares in % of LCA-using companies in each country)

In this case, the trend is very clear. In all countries, LCA are more and more carried out by internal teams. In Sweden, the percentage amounts up to 77% of LCA-companies. This suggests that the „internalisation” of LCA competences within the firm increases with the wider use of LCA.

4.3 Problems

What are the main methodological difficulties companies have met in implementing LCAs?³² Figure 4.3 shows the main methodological problems encountered by companies while performing an LCA study.

Clearly, major difficulties are connected with the inventory step of an LCA. Data collection and quality are perceived as the biggest problem in Italy, Germany, and Sweden (from 61% up to 67%). Switzerland (54%) seems to have a better data collection system. This might be explained by the existence of a variety of public data-bases carried out in collaboration with universities, research institutes and federal ministries and by the smaller size of the country. The second most important difficulty (40%-50%), namely the definition of system boundaries, is also related to the inventory phase. This problem is particularly perceived in Italy (56%), where there is no great experience of LCA within companies.

³² Several answers to this question were allowed.

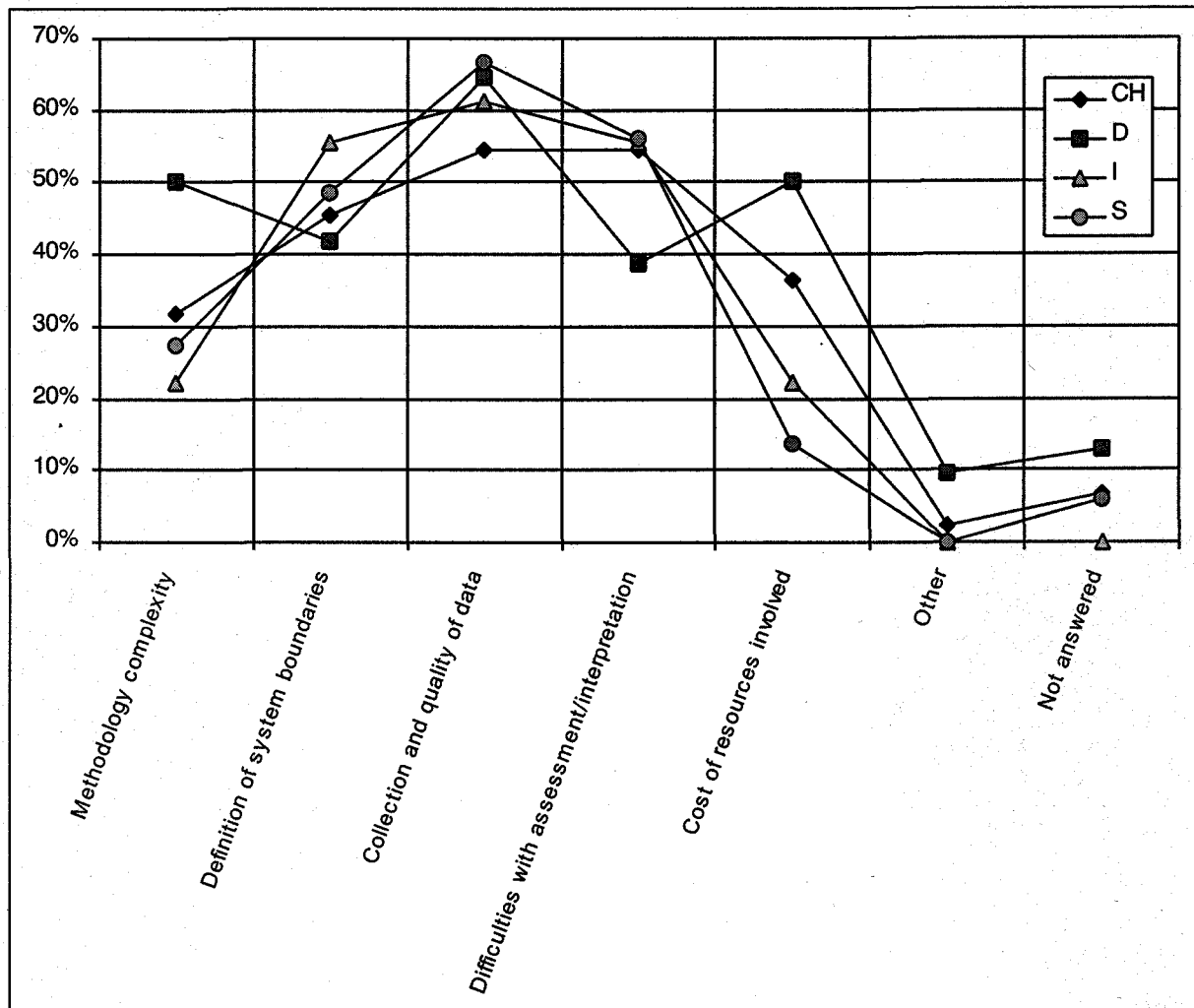


Figure 4.3: Methodological problems of doing an LCA (relative shares in % of LCA-using companies in each country)

As expected, a large group of companies has significant problems with the assessment and interpretation of results. This problem is less perceived in Germany (39% vs. around 55% in the other countries), but Germans refer much more (50%) to the general complexity of the methodology than other countries. The suggestion is that Italians are less expert in LCA and consequently less aware of the totality of problems. In Germany it might be an issue of „mentality“, as frequently no interpretations and impact assessments are carried out. Curiously, only in Germany (50%) - and partially in Switzerland (36%) - there is a clear reference to the costs of the resources involved in LCA. This does not seem to be perceived as a significant difficulty in Sweden (13%). A plausible explanation for this might be two-fold: On the other hand, LCA is more a routine tool in Sweden and practitioners profit from past experiences; moreover, they often carry out streamlined LCAs. On the other hand companies in Sweden receive more external support by the state and research institutes.

5 Outlook

This part reports on the expectations of companies for the future use of LCA in business. A wider use of this tool depends on the obstacles (section 5.1), on the trade-off between costs and expected benefits (section 5.2), and on the experience accumulated (including surprises, section 5.3 and 5.4).

5.1 Obstacles

Companies were asked about the main obstacles preventing a wider use of LCA within their companies³³. Figure 5.1 shows the main obstacles to a wider use of LCA in business study. Per cent values refer to the sum of LCA-using companies. Multiple answers were allowed.

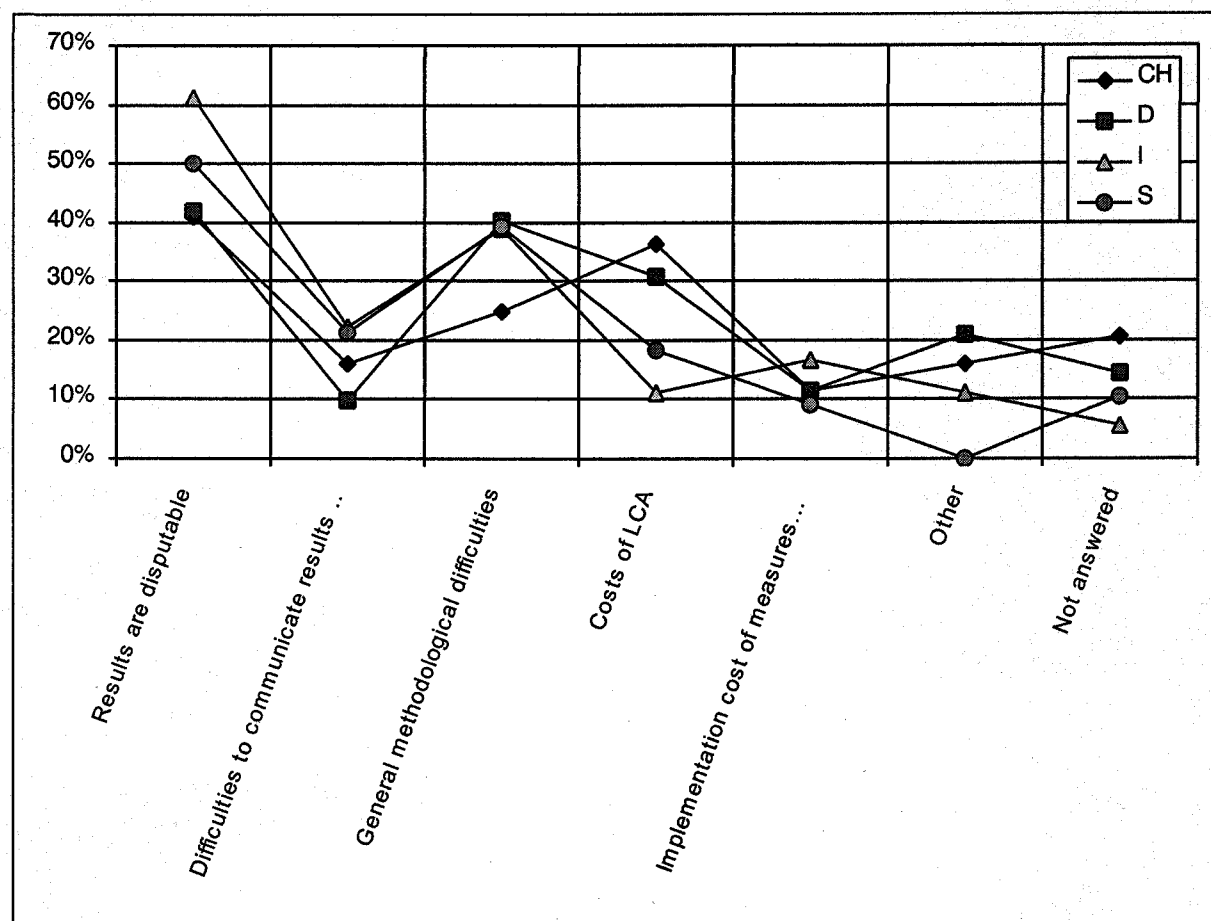


Figure 5.1: Main obstacles to a wider use of LCA (relative shares in % of LCA-using companies in each country)

The general trend is quite clear. Two results are similar in all countries: The major obstacle to a wider use of LCA in business is the fact that results are disputable (40% - 60%). The second common result is the low ranking of difficulties to communicate results to top management. This result is quite surprising.

General methodological difficulties are perceived as a significant obstacle in Germany, Italy and Sweden. The Swiss „deviation” must be interpreted with some care, because Switzerland’s rate of non-respondents in this case amounted to 20%. However, a plausible explanation for this might be that there is more public support by the state through its ministries and other important organisations (for example ÖBU, BUWAL) in this country.

The result referring to costs is consistent with the one of section 4.3: Costs are perceived as a main problem in Germany and Switzerland, but significantly less in Italy and Sweden. Interestingly, in no

³³ Several answers to this question were allowed.

country the cost of implementation of measures suggested by LCA are considered a main obstacle. To us, this is a rather surprising result. However this might be explained by the fact that many LCAs carried out up to now have been retrospective/learning ones and had not been intended from the beginning as a design tool to introduce changes in production. Most of these studies have been carried out within environmental departments, which are „far away” from accounting and production departments. Another possible explanation is that the cost is accepted anyway before the study starts.

5.2 Balance between costs and benefits

Companies were asked about the balance between costs and benefits of LCA³⁴. Figure 5.2 shows how companies assess the benefits deriving from carrying out LCA. Per cent values refer to the sum of LCA-using companies.

There are three similar results in all countries and one big difference between two groups of countries.

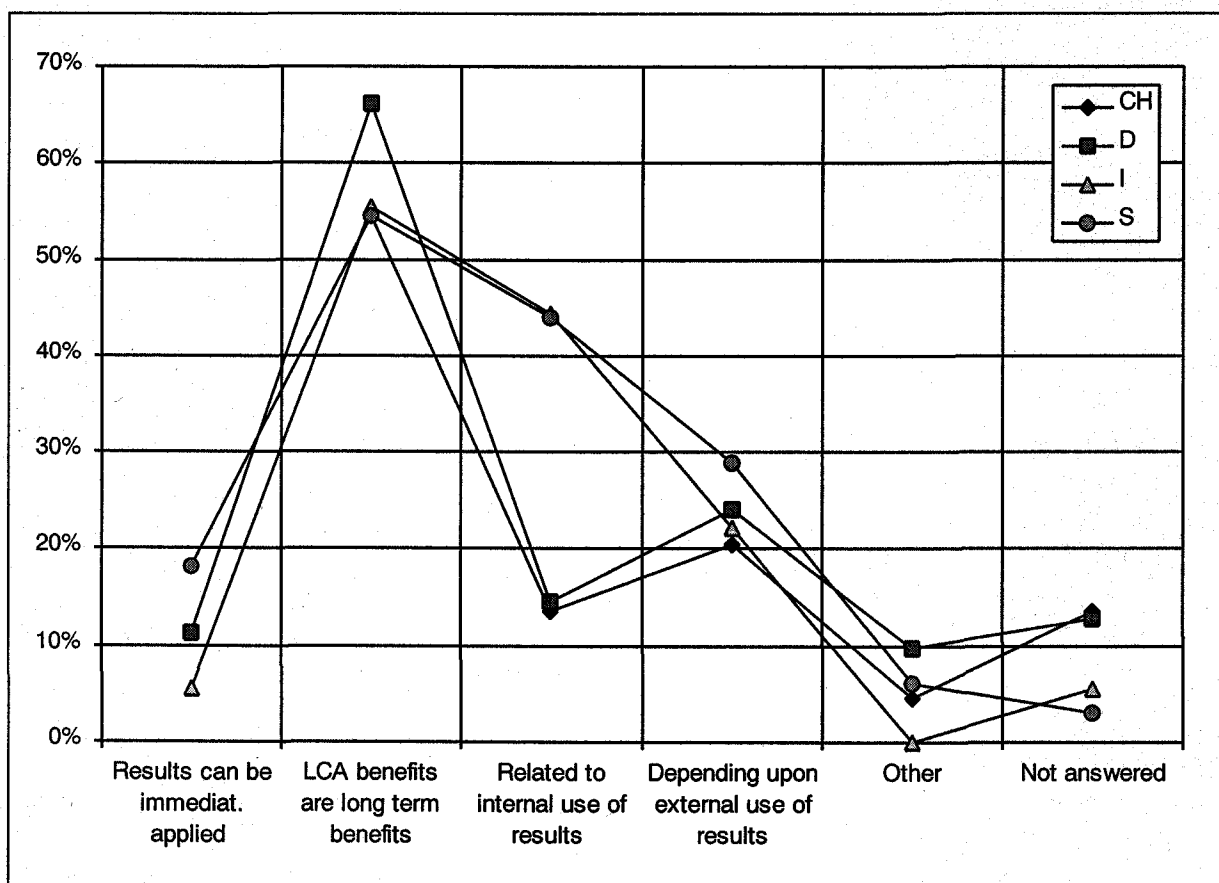


Figure 5.2: Benefits of LCA as they are perceived in companies in the different countries (relative shares in % of LCA-using companies in each country)

Companies in all countries do agree on the fact that results of LCA cannot easily be applied immediately and that benefits deriving from LCA are long-term benefits. A quite large percentage (20%-30%) of companies think that benefits depend on the possibility of diffusing results externally. However, results suggest that in Italy and Sweden LCA (and its benefits) is perceived mostly as an internal tool,

³⁴ Several answers to this question were allowed.

whereas in Switzerland and Germany there is a stronger focus on the external use of LCA. This result is consistent, at least to some extent, with the results reported in sections 3.1 and 3.2.

5.3 Surprises

Companies were asked if LCA produced any surprises³⁵. Being asked whether they had had surprising results arising from the LCA, 44% of Italian companies answered *yes*, 28% *no*, and another 28% *do not know*. This result is consistent with the early stage of development of LCA methodology in this country. Germany has slightly more surprising results³⁶, while 47% of the Swedish companies answered *no*. Very clearly, Swiss companies were least surprised by LCA results (61% vs. 27%).

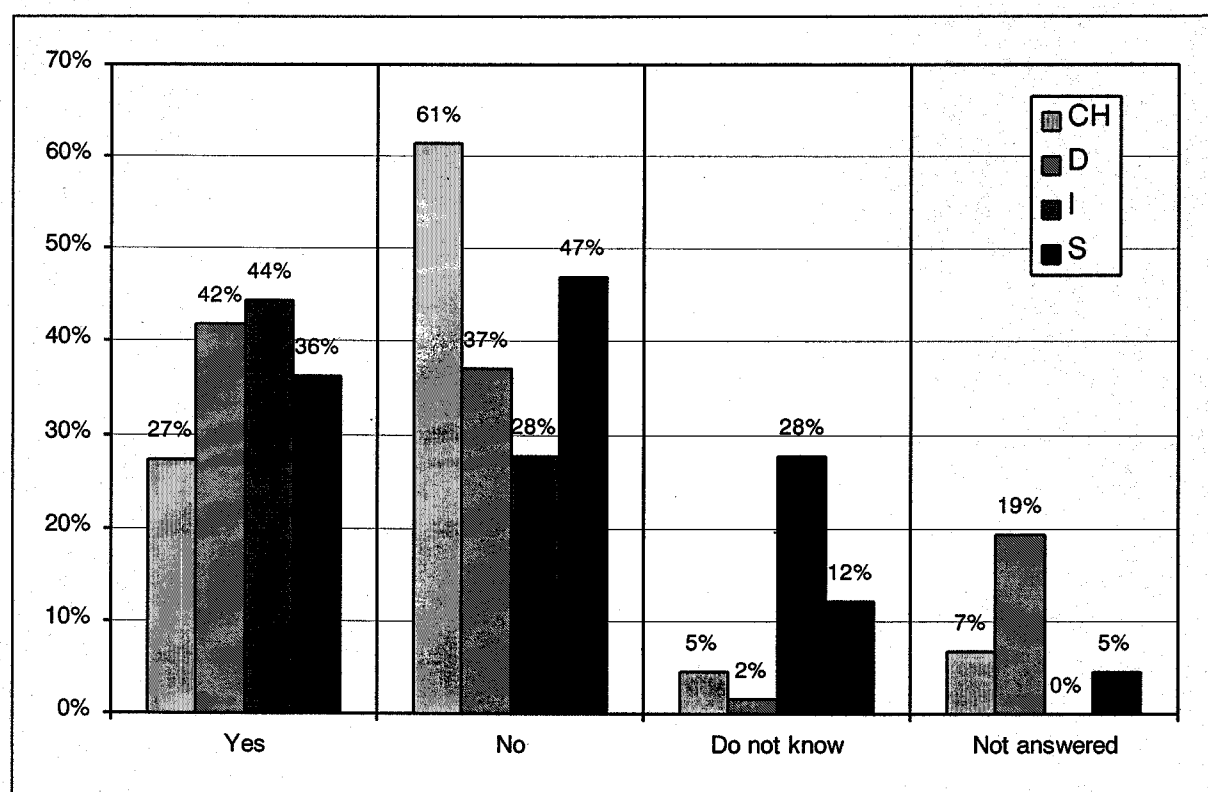


Figure 5.3: Surprising results arising from LCA in different countries (relative shares in % of LCA-using companies in each country)

5.4 Increase of LCA-studies

In order to define an outlook for the future use of LCA in business decision-making processes, companies were finally asked if the use of LCA in their opinion would increase or not³⁷. Figure 5.4 shows the answers in the different countries. Per cent values refer to the sum of LCA-using companies. Multiple answers were allowed.

³⁵ Only one answer to this question was possible.

³⁶ However, this result may be influenced by the high rate of non-respondents.

³⁷ Several answers to this question were allowed.

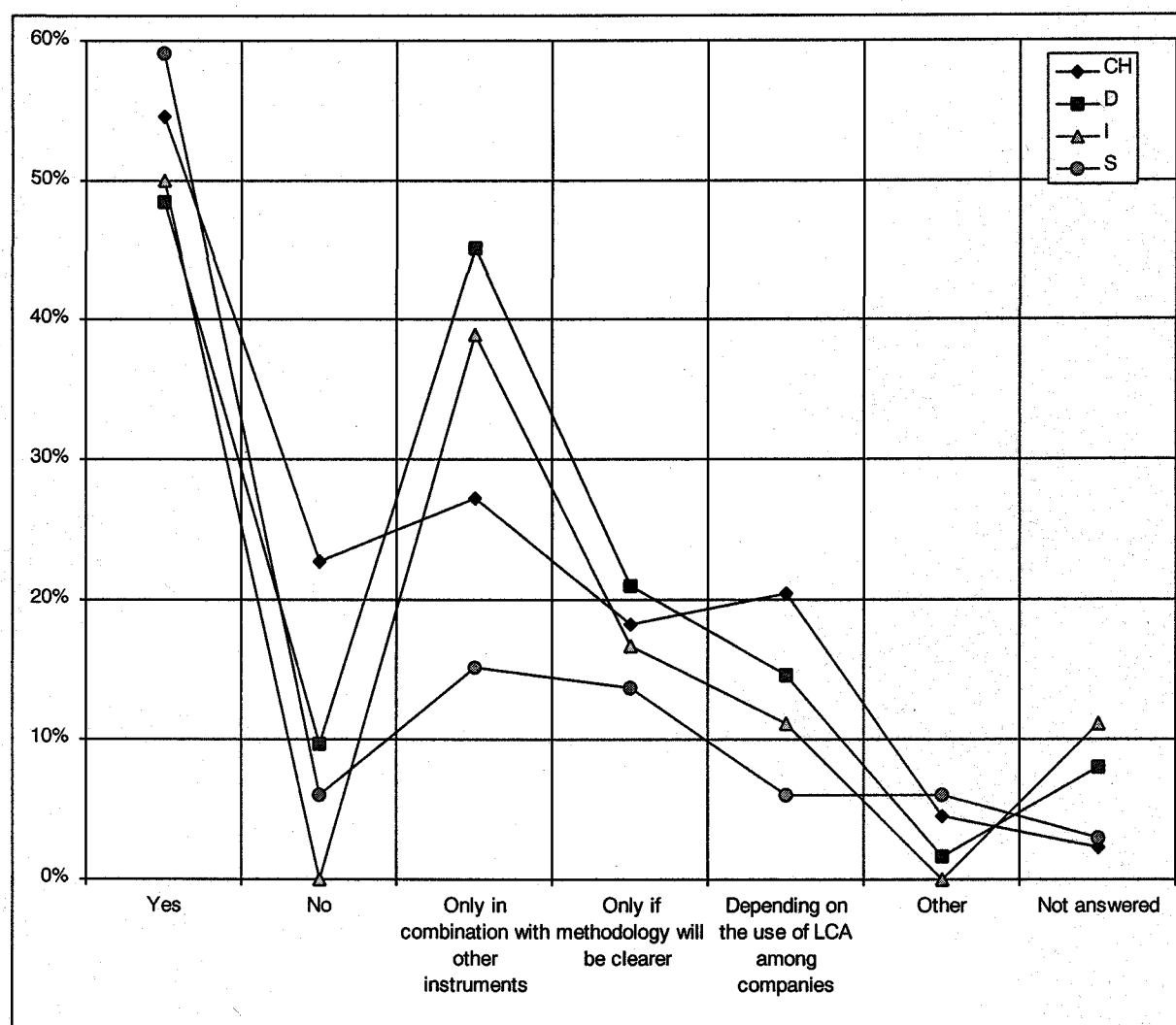


Figure 5.4: Increased use of LCA in companies in different countries (relative shares in % of LCA-using companies in each country)

Companies are generally optimistic about the future use of LCA as a supporting tool for business. The main results can be summarised as follows: A large percentage of companies (up to almost 60% in Sweden) think that the use of LCA will increase in the future in any case. Contrary to these, only few companies (with the partial exception of 23% of Swiss LCA-using companies) think, that is that the use of LCA will decline in the future.

The large difference between the answers to *only if used together with other instruments* suggests that Swedish companies are largely convinced that LCA will further develop on its own and does not necessarily need other auxiliary instruments for expanding its role in business. This is further confirmed by the low response rate to *only if the methodology will be clearer* and *depending on the spread of LCA among companies*. This opinion is much less supported in other countries, particularly in Germany and Italy.

6 Product innovation and LCA

This part tries to answer the question if there is a connection between the use of LCA and (environmental) product innovation in companies. The first two sections (6.1 and 6.2) show at which level of the company product innovation is defined and which the main drivers for change are. The next two sections (6.3 and 6.4) analyse the functions in general and to which extent environmental officers/departments in particular are involved in the process of (environmental) product innovation. Finally, section 6.5 shows those management tools (including LCA) which are used most frequently in the context of environmental product innovation.

6.1 Definition level of product innovation

Figure 6.1 shows that product innovation is mainly defined at the following company levels (in order of importance): corporate strategy, marketing, and R&D³⁸.

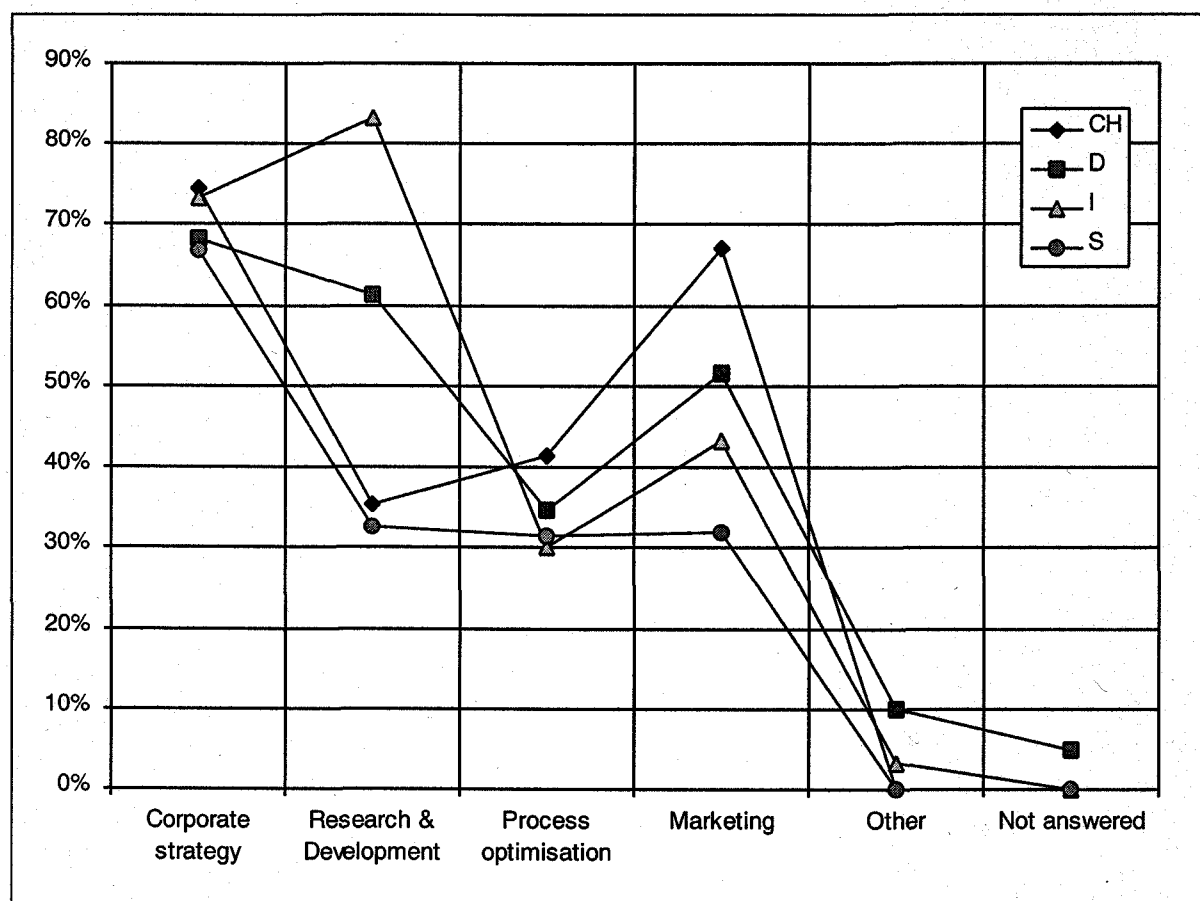


Figure 6.1: Company functions involved in the definition of product innovation (relative shares in % of all respondent companies in each country)

In the case of Sweden, product innovation is almost exclusively defined at the corporate strategy stage. The Italian result as to R&D must be handled with care, as it is not consistent neither with the outcomes of the case-studies nor with other results (see section 6.3).

³⁸ Several answers to this question were allowed.

Results are expressed in per cent in order to allow comparisons between the countries. The percentage refers to the total of answering companies (LCA-using and non LCA-using ones). Several answers were possible.

6.2 Drivers for product innovation

Product innovations can be stimulated by different drivers. The following figure presents the ranking results of the main drivers for product innovation in the different countries³⁹.

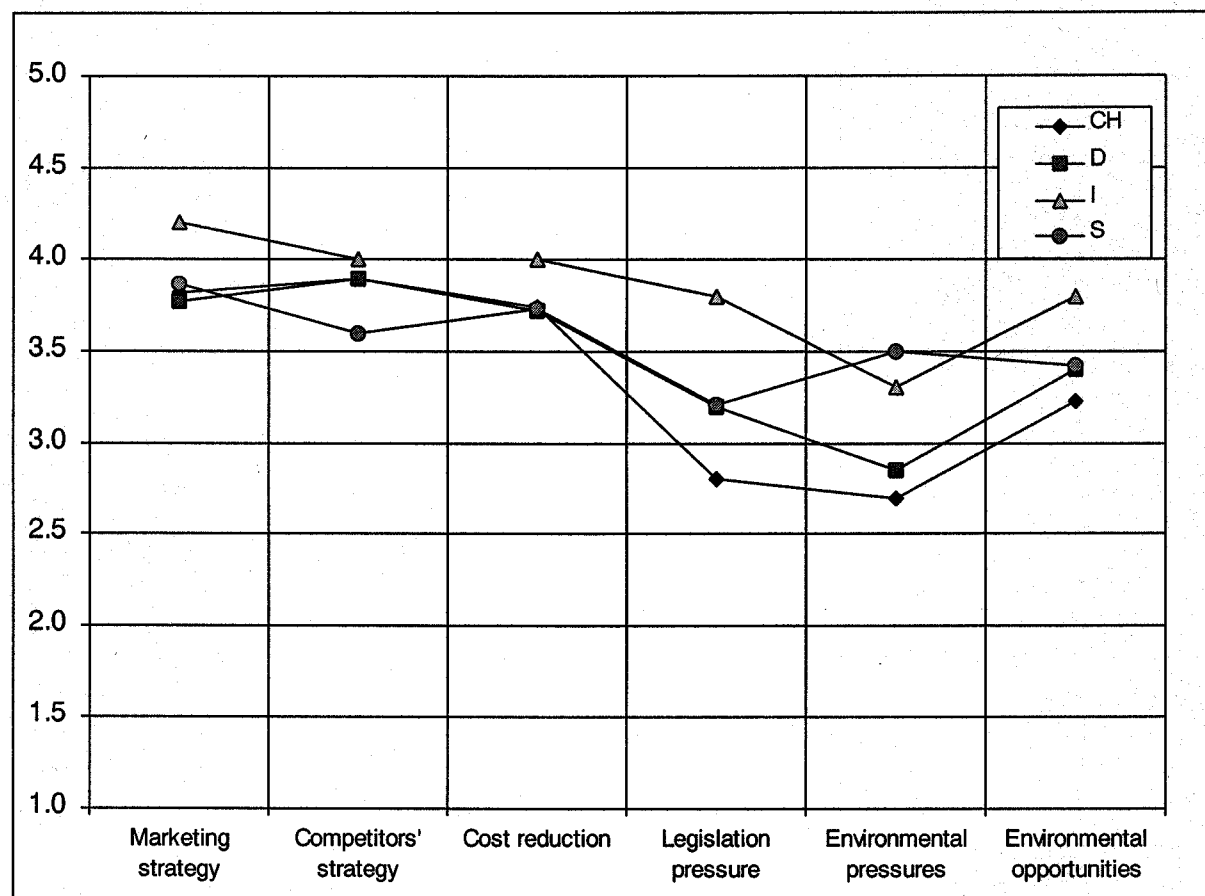


Figure 6.2: Drivers for product innovation (relative importance - weighted mean ranking values of all respondent companies in each country)

There is a quite similar trend in all countries. Firstly, product innovation is mainly driven by the market, i.e. costs and competition. There are only small differences between groups of countries as far as relative rankings of competitors with respect to marketing and costs are concerned. Secondly, everywhere environmental pressure is the least relevant driving factor for product innovation. Thirdly, interestingly environmental *opportunities* are ranked higher than environmental and legal pressures. There is only a slight exception to this in Italy with respect to legal pressure. As already observed in other previous cases, rankings in Italy tend to be systematically higher than in other countries. This might reflect more a „cultural“ emphasising attitude, than a real difference in evaluating the different driving factors.

³⁹ The method of weighting is described in section 1.3. Refusals are excluded from the calculation. A comparison revealed modest differences.

Figure 6.3 shows the relative ranking value of LCA-using companies vs. non LCA-using companies. The indicator is constructed by dividing the average ranking of LCA-using companies by the average ranking of non LCA-using companies. The 100% reference case is when the rankings of the two groups of companies are equal.

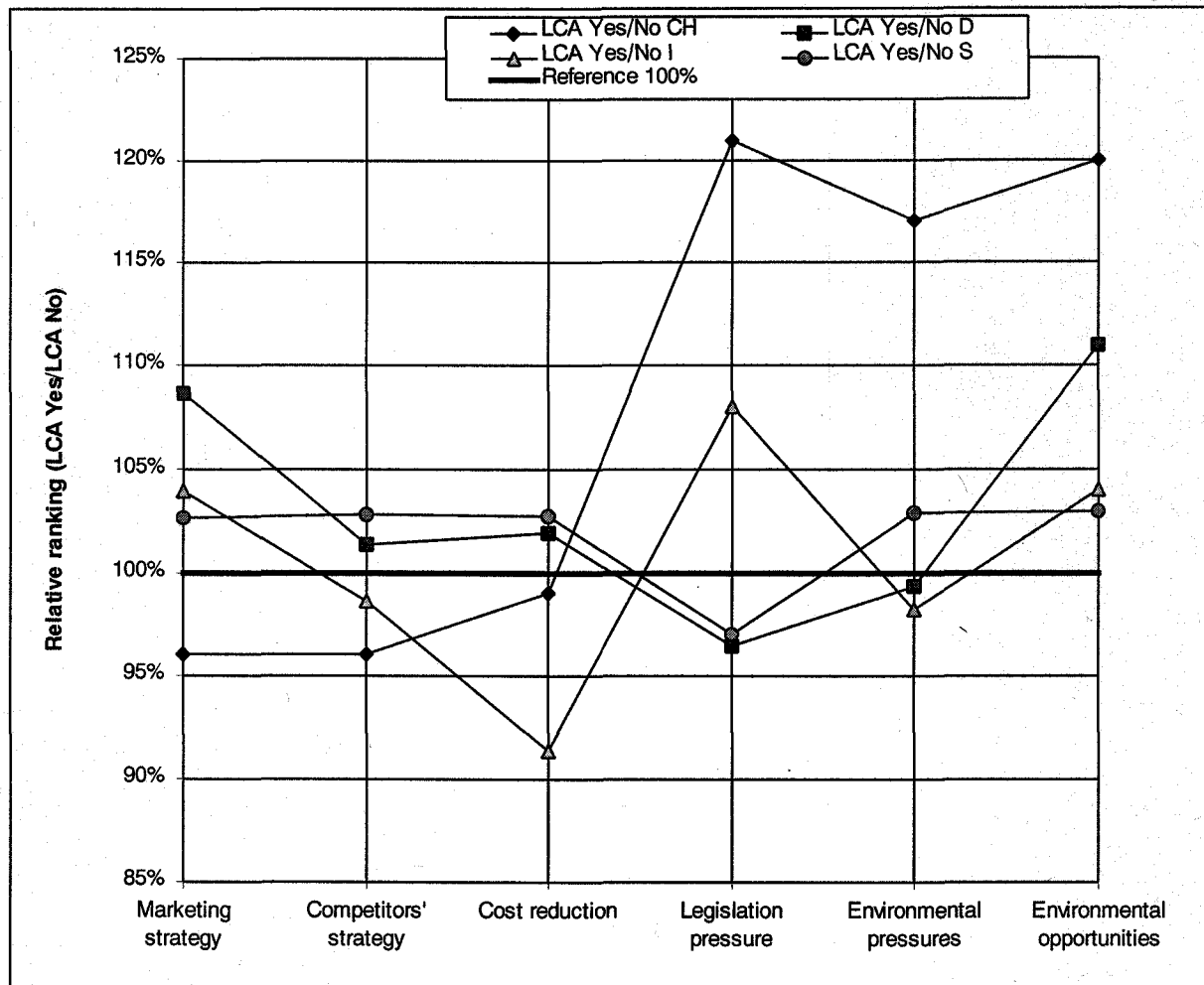


Figure 6.3: Ranking ratios of drivers for product innovation between LCA-using and non-LCA-using companies (ranking values of LCA companies / ranking values of non-LCA companies)

The situation is quite different in the various countries. In Switzerland, LCA companies rank *legislation pressure*, *environmental pressures* and *environmental opportunities* significantly higher than non-LCA companies. Swedish LCA companies rank all drivers slightly higher than non-LCA companies, with the only exception of *legislation pressure*. This situation is quite similar in Germany, whereas *marketing strategy* and *environmental opportunities* are ranked significantly higher. In Italy, it is worth to mention the high ranking of *legislation pressure* and the low ranking of *cost reduction* by LCA using companies.

6.3 Involved departments / functions

We queried about the functions or departments normally involved in the definition of product innova-

tion programmes⁴⁰. Figure 6.4 shows the results.

In all countries, the mostly involved departments are the top management and the marketing and sales department. The research, development, design and production departments are much less involved (R&D and product development and design particularly less in Italy).

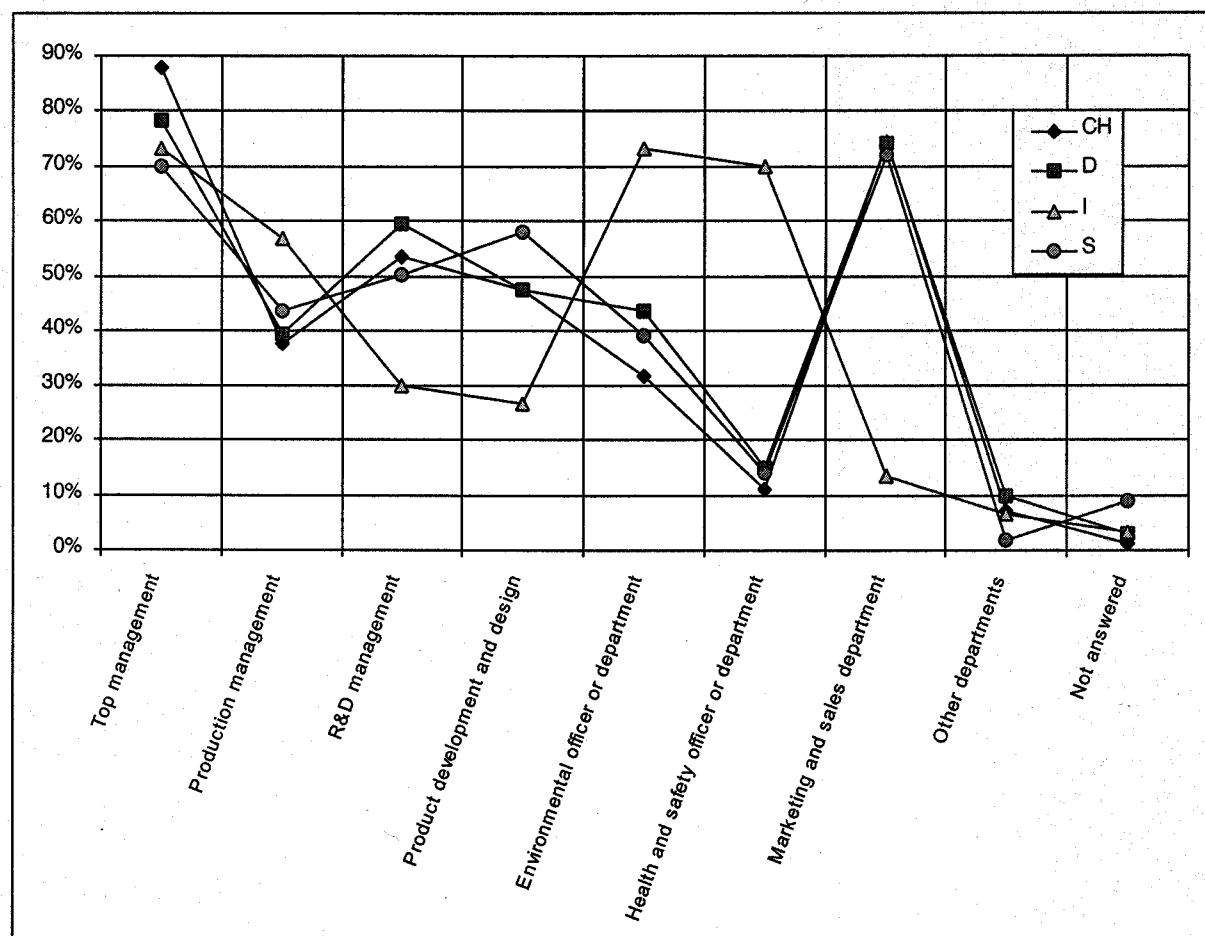


Figure 6.4: Departments/Functions involved in product innovation (relative shares in % of all respondent companies in each country)

Italy shows a peculiar result: while in other countries environmental and health & safety officers are rarely involved in product innovation patterns (health & safety officers are least involved), 70% of Italian companies (the same value as for marketing departments) declare that their environmental and health& safety officers are involved in product innovation activities. A plausible explanation for this is twofold: On the one hand, in many cases the two positions coincide within the firm (this explains the approximately same value in the two cases). On the other hand, since the introduction in 1996 of a new law about safety, Italian companies have reacted by giving more importance and power to their health& safety departments.

⁴⁰ Several answers to this question were allowed.

6.4 Role of environmental and health/safety managers

Another question was dedicated to the role of the environmental officer and/or environment, health and safety department in the product innovation process⁴¹.

The result presented in the previous section is confirmed by the fact that a significantly higher percentage of environmental managers are active participants in most cases of product innovation in Italy, whereas in other countries they are mainly occasional consultants within the framework of product innovation activities. Quite rarely the environmental manager and/or health & safety manager is the initiator of product innovation. Curiously, this is particularly true in Italy, where there is the maximum of active participation level.

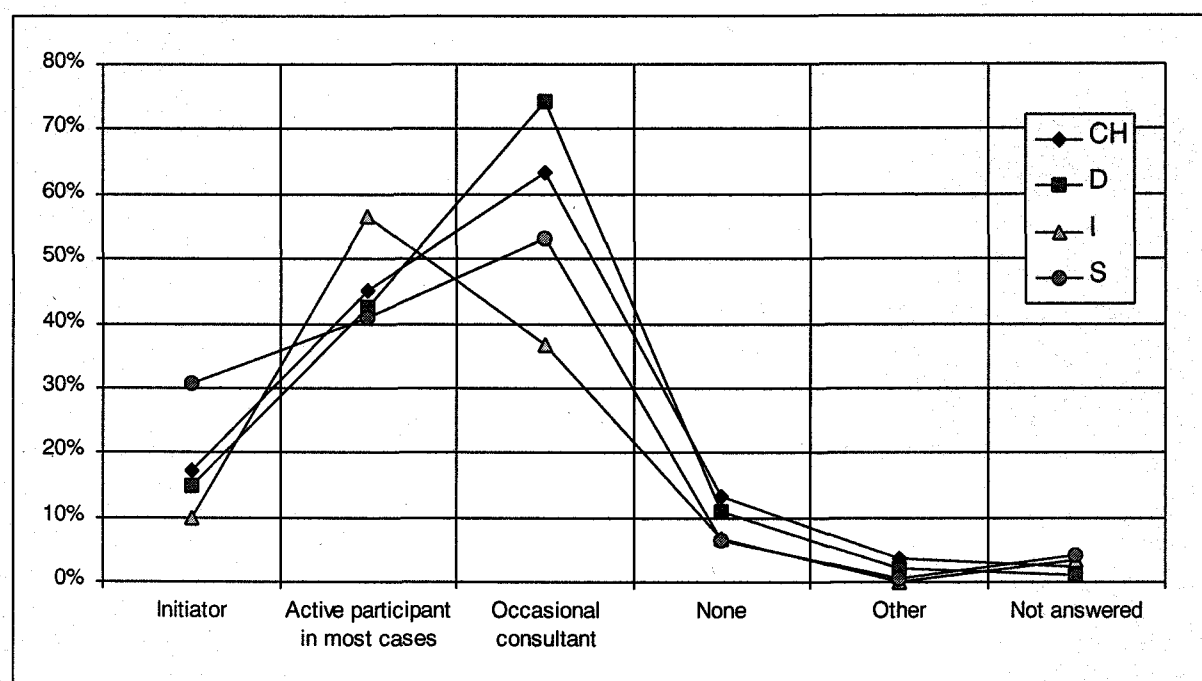


Figure 6.5: Role of environmental managers and/or health & safety managers in product innovation (relative shares in % of all respondent companies in each country)

6.5 Tools for environmental product innovation

Finally, the companies were asked which kind of tools (including LCA) they use to improve their products environmentally⁴². Figure 6.6 shows the set of tools used by companies. Results are expressed in per cent to compare the situations in the different countries.

Figure 6.6 shows a quiet similar trend in Switzerland, Germany and Sweden. Once again, Italy has some different results. In the former three countries, at least four tools (checklists, compliance/gap analysis with legislation, risk assessment and energy efficiency analysis) are used to more or less the same extent (30%-50% of the companies). Material balances are used at the same level in Germany and Switzerland, but less in Italy and Sweden. With the exception of Italy, environmental impact assessment is the least used tool for environmental product innovation. As a matter of fact, environ-

⁴¹ Up to two answers to this question were allowed.

⁴² Several answers to this question were allowed.

mental impact assessment has been rather site-specific up to now and not been related to products.

The other significantly different result for Italy is a much wider use of compliance/gap analysis with legislation. This might be interpreted as a rather reactive attitude of companies with respect to environmental issues.

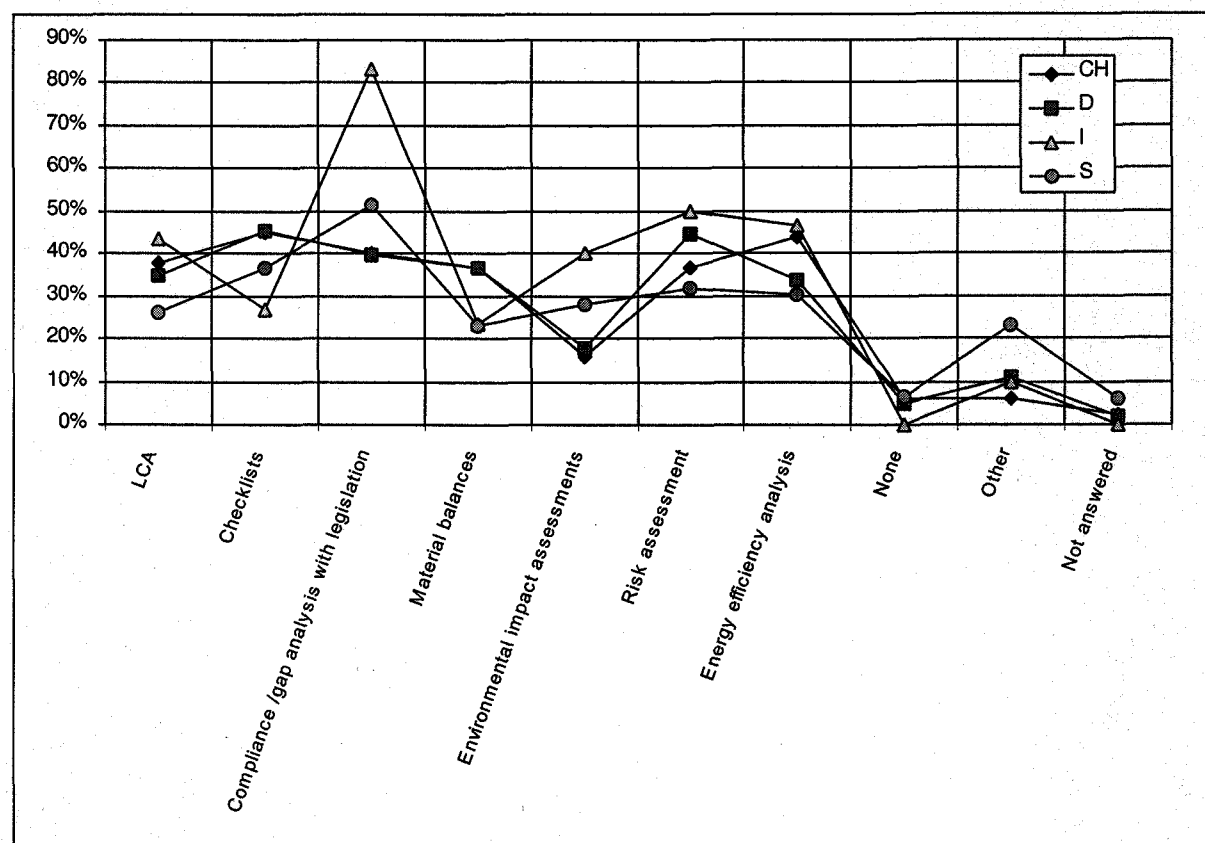


Figure 6.6: Mostly used management tools in the context of environmental improvements of products (relative shares in % of all respondent companies in each country)

Finally, an observation has to be made on the item *use of LCA* in itself. The relatively low percentage shown in Figure 6.6 is due to including LCA-using and non-LCA companies in the calculation of the average percentage. The percentage of LCA-companies using LCA for making product environmental improvements, that is in a more prospective than retrospective manner, is of course significantly higher (61% in Switzerland, 53% in Germany, 67% in Italy, 29% in Sweden) than the value responding shown. The fact that the Swedish percentage is the lowest is due to the fact that 60% of the companies answering the questionnaire are *not* using LCA (see also section 1.2).

Curiously, also a few non-LCA companies *do* declare to *use* LCA or parts of it (inventory) to introduce environmental improvements of their products.

Figure 6.7 shows the differences between LCA and non-LCA companies, as far as the other tools are concerned (LCA itself is excluded for a better graphic scale). The parameter for comparison is the percentage of LCA companies divided by the percentage of non-LCA companies.

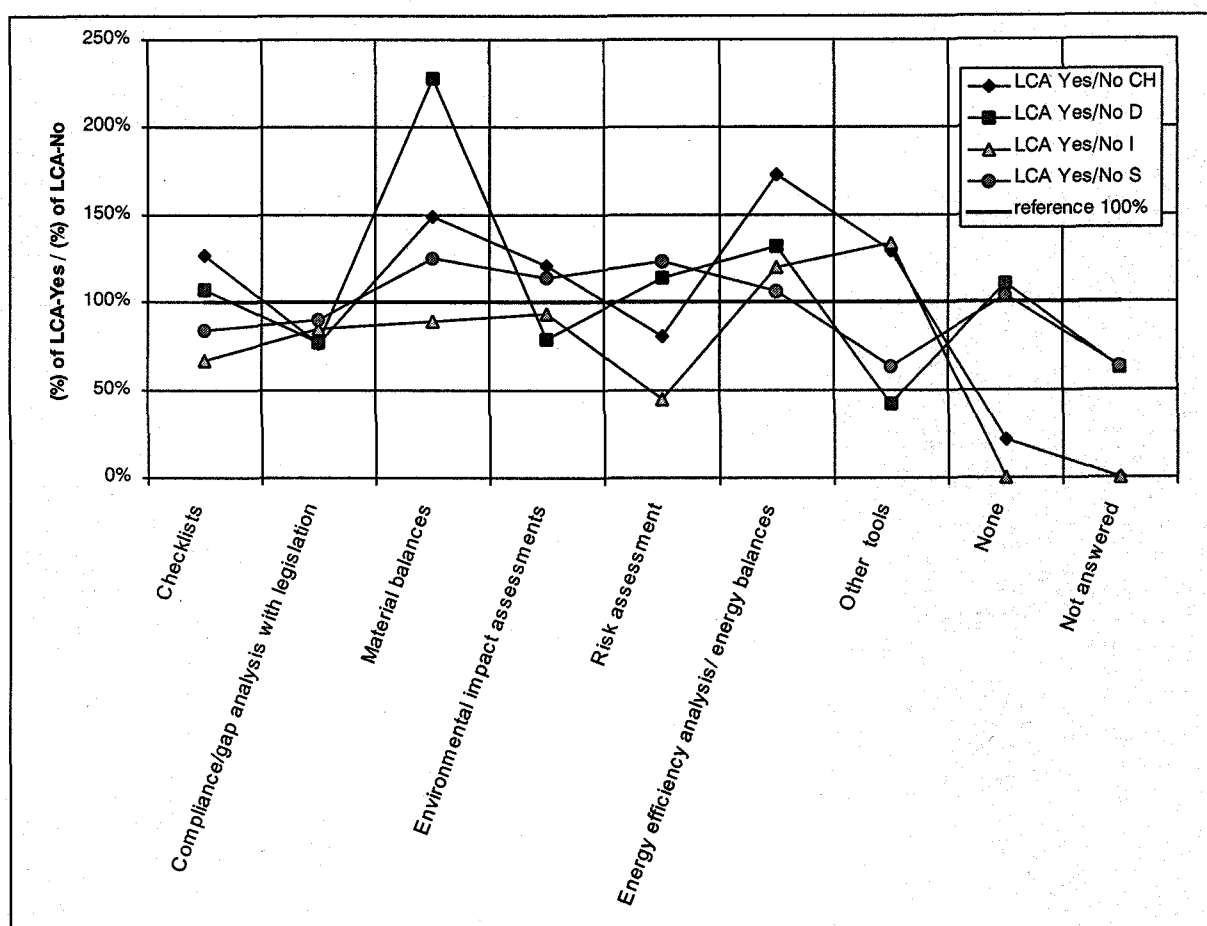


Figure 6.7: Differences between LCA and non-LCA companies as to the use of other tools (than LCA) for environmental product innovation (% of LCA companies divided by % of non-LCA companies)

The situation is a little different in the four countries. In Switzerland and Germany, LCA companies tend to use a larger set of tools for environmental product improvements.

- **Germany:** LCA-using companies use material balances much more frequently than non-LCA companies. In addition, they carry out energy efficiency analyses and/or balances as well as risk assessments more often. This may be related to the "history" of LCA, which was an evolution of energy and material analysis.
- **Switzerland:** as in Germany, LCA companies use more material and energy balances.
- **Italy:** LCA-using companies use energy analyses and balances more than companies not using LCA. However, all other values are below 100%. This suggests that in Italy *non LCA* companies tend to use other tools for environmental product innovation more than LCA companies.
- **Sweden:** LCA-using companies use material balances and risk assessments more than companies which do not use LCA.

These results suggest following conclusions: Today, product innovation is driven by marketing, costs and competition. In all countries environmental pressure is the least relevant factor for pushing product innovation. The most involved departments are top management and marketing and sales

departments. Environmental departments/officers usually do not take regularly part in product innovation processes⁴³.

Thus, it might be concluded that there is *not* a straightforward connection between LCA and (environmental) product innovation today. This is further confirmed by the fact that only 50%-60% of the LCA companies declared to apply LCA itself for environmental product improvements.

However, LCA-using companies rank drivers slightly higher, in particular marketing and environmental opportunities⁴⁴. LCA companies also tend to use a larger mix of tools for product environmental assessment and improvement.

7 Political expectations

In this chapter, we describe the political expectations of business. In section 7.1.1 we present the influences of current governmental environmental policies; section 7.1.2 contains future prospects and section 7.2 is dedicated to the preferences of business for voluntary and/or mandatory measures. We also asked whether European or national measures are preferred (see section 7.3).

7.1 Influences of governmental environmental politics

The political climate was treated in several questions of the questionnaire. We investigated how current and future governmental environmental policies and measures affect the way companies do business. Results as to current policies are presented in section 7.1.1, as to future policies in section 7.1.2.

7.1.1 Current political measures and actions

Governmental environmental politics may influence business activities in many ways. Therefore, we asked for a ranking of 13 different measures and activities which might affect business at present⁴⁵. Once again, we distinguished between companies using and not using LCA. The results are:

- **Switzerland:** *Covenants*, *product standards* and *certification schemes* are the most affecting present measures/actions according to both groups. LCA-companies tend to rank most of the measures higher than companies not using LCA; considerable higher rankings exist for *public data bases for LCA* (inventory of data) [+0.8 points] and for *green design guidelines* [+0.4 points].
- **Germany:** At present, the most affecting measures for both groups of companies are *certification schemes* and *eco-auditing*; LCA-companies also rank *covenants* high whereas non-LCA companies rank *product standards* high. Comparing the results of both groups one recognises that some measures are ranked slightly differently by the companies, greater differences exist in the case of *covenants* [+0.5 points]; however, the general tendency is that LCA-companies tend to rank most of the measures higher than companies of the other group.

⁴³ Italy seems to be an exception, but this may be due to the health&safety manager function, which often coincides with the environmental one in Italian companies.

⁴⁴ And legislation pressure in Switzerland and Italy.

⁴⁵ Several answers to this question were allowed.

- **Italy:** At present, the actions mostly affecting both groups are *eco-auditing*, *certification schemes* *product standards*. LCA-companies are also affected by *process standards*, non-LCA companies by *take-back systems*. Less affecting measures are sector LCI data-bases for both groups and covenants and green R&D-programmes by LCA-users. Comparing the results of both groups, it is a little bit surprising that companies indicating not to use LCA rank most measures higher than companies using LCA.

Table 7.1: Correlation between different *present* political measures and the use of LCA in the four countries (ranking list) ⁴⁶

Action	CH		D		I		S	
	LCA yes	LCA no	LCA yes	LCA no	LCA yes	LCA no	LCA yes	LCA no
Certification schemes								
Product standards		A	B	A	A	A	B	B
Eco-auditing	B	B			A	A		B
Product/packaging take-back systems	B	B	B	B	B	A	A	A
Covenants/sector codes of practice	A	A	A	B	C	B	B	A
Process standards	B	B	B	B	B	A	B	B
Eco-labelling	C	B	B	B	B	B	B	A
Green government purchasing	B	B	C	B	B	B	B	B
LCA-based tax schemes	B	B	C	C	B	C	n.a.	n.a.
Green design guidelines and awards	B	C	B	B	B	C	C	C
Green R&D programme	C	C	C	C	C	B	B	B
Green public investment funds	C	B	C	C	B	B	C	C
Sectoral LCI public data bases	B	C	B	C	C	C	C	C

Explanation: A = high importance
 B = medium importance
 C = low importance
 n.a. = not available

- **Sweden⁴⁷** : Swedish companies of both groups tend to rank *take-back systems* and *certification schemes* highest; LCA-companies state that *eco-auditing* affects them; companies not using LCA list *eco-labelling* and *covenants* at the top of the list. Nearly all actions are ranked higher by the companies using LCA in comparison to the companies of the second group; the most

⁴⁶ The method of the ranking into A-B-C is described in section 1.3.

⁴⁷ Due to a specific national situation, we did not ask about the tax-schemes.

important higher rankings exist in the case of *eco-auditing* [+0.6 points], *certification schemes* [+0.5 points], *public LCA data bases* [+0.6 points], *green design guidelines* [+0.5 points] and *green investment funds* [+0.5 points],

LCA **using** companies are especially affected by *certification schemes* (all countries), by *eco-auditing* (in all countries except Switzerland), by *product standards* (Switzerland and Germany), by *covenants* (Switzerland and Germany), and by *take-back systems* (Sweden).

Companies which do **not use** LCA are especially affected by *certification schemes* (all countries), by *eco-auditing* (except Switzerland), by *product standards* (all countries except Sweden), by *covenants* (all except Germany and Italy) and by *take-back systems* (except Germany and Switzerland).

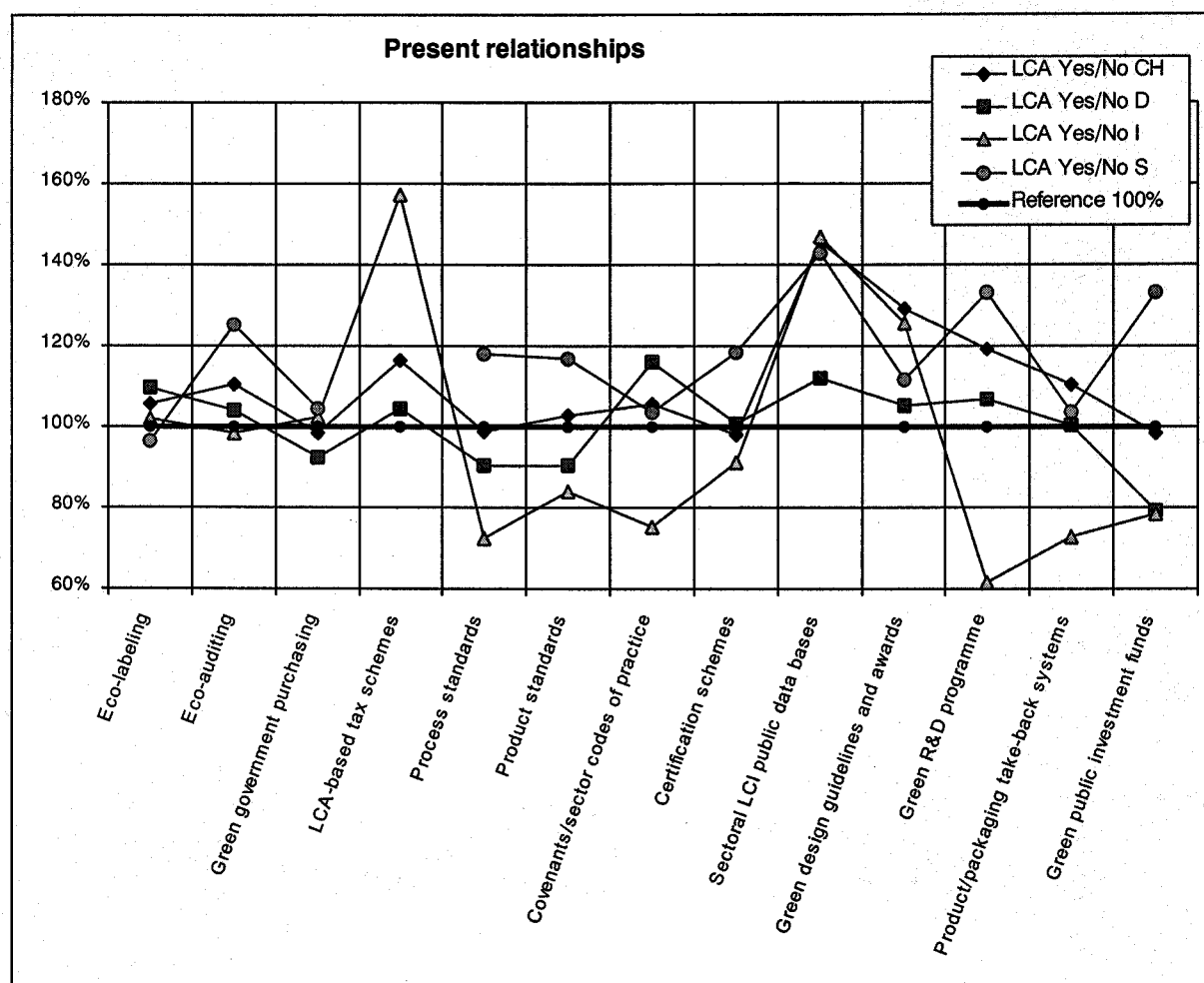


Figure 7.1: Relationship between companies using and not-using LCA with regard to **present** policy actions/measures [relative importances]

According to our survey and the answers given by the participating companies, some present measures/actions affect them considerably, namely *certification schemes*, *product standards*, *covenants*, *eco-auditing* and *take-back systems*. At the bottom of this qualitative evaluation of affecting actions are *tax-schemes*⁴⁸, *public LCA-data*, *green design guidelines* and particularly *green R&D pro-*

⁴⁸ However, one has to doubt that the respondents considered the relationship between eco-taxes and LCA-results; we suppose that they refer to eco-taxes in general and not to LCA based tax measures.

gramme. Especially the role of *covenants* as a voluntary action seems to differ among the countries.

Are there differences in the perception of political measures/ actions between both groups of companies (see Figure 7.1)? In most cases, German and Swiss LCA using companies tend to believe to be affected by policy actions/measures more than companies not using LCA. Swedish companies using LCA rank all policy actions/measures (except eco-labelling) higher than companies of the second group. However, the Italian situation is different in contrast to the three other countries; especially tax-schemes⁴⁹ and LCI-data-bases are ranked extremely higher by LCA companies; this is also valid for green design guidelines; in contrast to this, green R&D programmes, take-back systems, standards and covenants are ranked lower.

7.1.2 Future environmental policy measures

Governmental environmental politics may influence business activities in many ways. Apart from the current situation, we investigated expectations for the future by ranking measures and actions which might affect business within the following five years. The results are:

- **Switzerland:** the general tendency is that future measures are ranked higher than the present measures. The most important future actions which would affect both groups of companies are *certification schemes*, *covenants*, *product standards* and *tax schemes*; companies not using LCA indicated that also *take-back systems* and *eco-auditing* would affect them. The differences between both groups of companies are relatively small (less than 0.4 points).
- **Germany:** the arithmetic means do not reveal great differences between both groups - with one exception: LCA-using companies rank *covenants/sector code of practice* 0.5 point higher than the other group. The most affecting actions are *eco-auditing* and *certification schemes* for both groups, *covenants* in the case of LCA-companies as well as *take-back systems* in the case of non LCA-companies.
- **Italy:** similarly to the other countries, *certification schemes* are ranked at the top. LCA-using companies are affected also by *product standards* and *take-back-systems*; companies not using LCA will be affected in the future by *green public purchasement* and *process standards*. This is a hint that product and process standards are perceived differently by the two groups.
- **Sweden:** the tendency is the same as in the other countries. LCA-using companies rank future policy measures/actions on average by 0.7 points higher and companies not using LCA by 0.8 points than present policy measures/actions. LCA-using companies rank especially *LCI-data-bases* higher in the future. Companies of the other group expect to be especially affected by *LCI-data-bases* and *eco-audit*.

The general trend is that future political actions/measures are expected to affect business more significantly than today.

⁴⁹ However, one has to doubt that the respondents considered the relationship between eco-taxes and LCA-results; we suppose that they refer to eco-taxes in general and not to LCA based tax measures.

Table 7.2: Correlation between different *future* political measures and the use of LCA in the four countries (qualitative ranking list)⁵⁰

Actions	CH		D		I		S	
	LCA yes	LCA no	LCA yes	LCA no	LCA yes	LCA no	LCA yes	LCA no
Certification schemes								
Eco-auditing	B	A			B	B		A
Product/packaging take-back systems	B		B		A	B	A	A
Product standards	A		B	B	A	B	B	B
Covenants/sector codes of practice				B	B	B	B	B
LCA-based tax schemes			B	B	B	B	n.a.	n.a.
Green government purchasing	B	B	C	B	B		B	B
Process standards	B	B	B	B	B	A	C	B
Eco-labelling	B	C	B	B	B	B	B	B
Sectoral LCI public data bases	B	C	B	C	B	C	B	B
Green design guidelines and awards	C	C	B	B	C	B	C	C
Green R&D programme	C	C	C	C	C	C	B	C
Green public investment funds	C	B	C	C	C	C	C	C

Explanation: A = high importance
 B = medium importance
 C = low importance
 n.a. = not available

Are there differences in the assessment of the future political actions between both groups of companies (see Figure 7.2)? German, Swedish and Swiss LCA using companies tend to believe that they will be more affected by future political actions/measures more than companies not using LCA. Especially eco-labelling, covenants, LCA data bases and green design guidelines (except Sweden) are expected to affect LCA-companies more. However, the Italian situation is different compared to the three other countries; in most Italian cases, companies using LCA rank political actions lower than companies of the second group.

⁵⁰ The method of ranking into A-B-C is described in section 1.3.

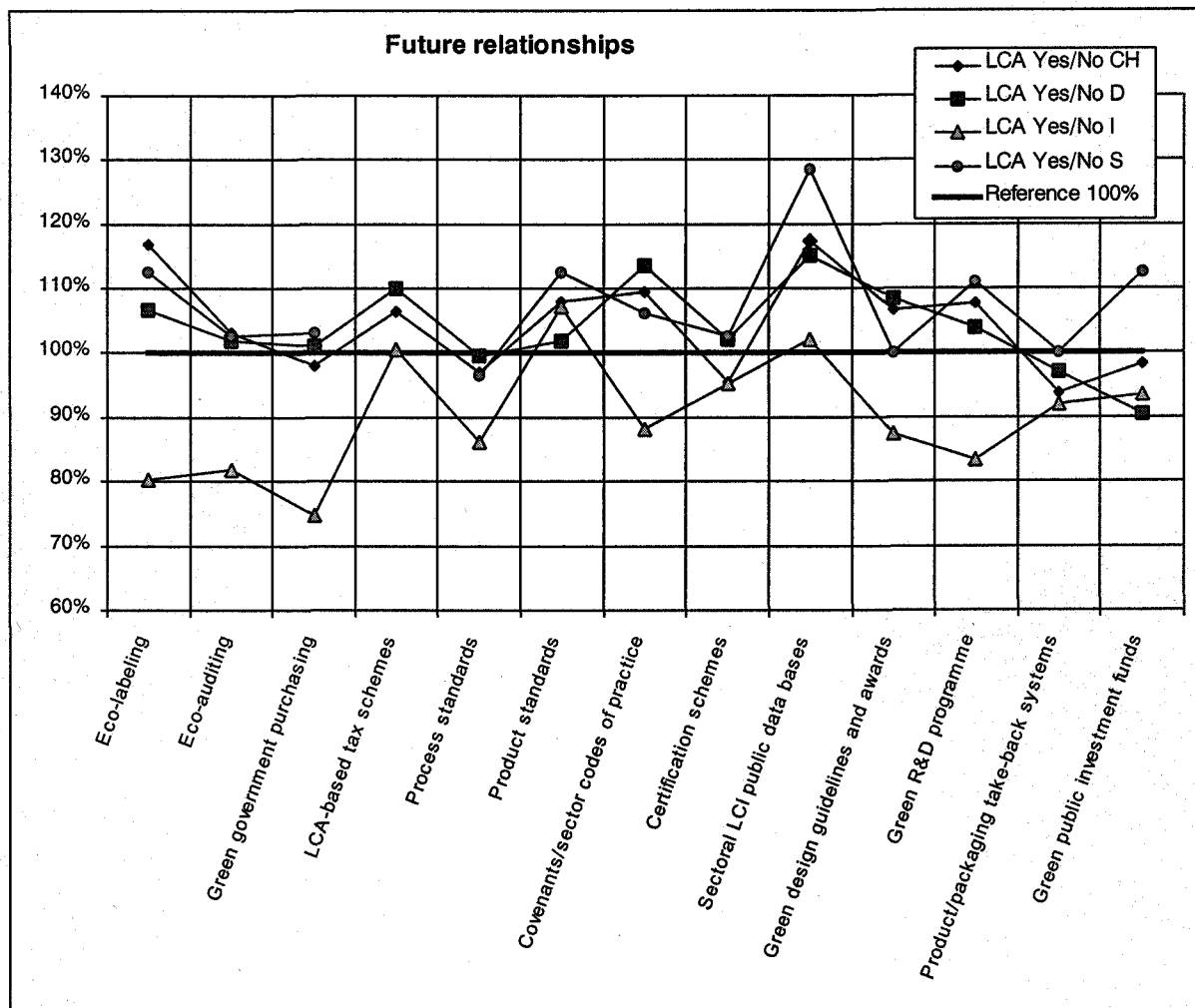


Figure 7.2: Relationship between companies using and not-using LCA with regard to *future* political actions/measures

7.2 Necessary actions and measures

In the two sections above, we asked companies if different measures affect their way of doing business; another question was: Which of the 14 different proposed measures *will be* necessary according to their opinion⁵¹. We have not distinguished between both groups of companies, i.e. results are made up for all answers (see Figure 7.3):

- **Switzerland:** The companies answering this question declare that eco-auditing, covenants/sector codes, LCA-based tax-schemes, certification schemes and take-back-systems will be necessary.
- **Germany:** In the opinion of the responding companies five measures will be mandatory: eco-auditing, covenants/sector codes, LCA-based tax-schemes, certification schemes and take-back-systems. All other actions are relatively unimportant.
- **Italy:** According to the answering companies take-back-systems are the most necessary measure. In addition, a lot of other measures were listed, non of which, however, was assessed

⁵¹ Several answers to this question were allowed.

as similarly important. Interestingly, tax-schemes and green design guidelines were rejected completely as necessary measures.

- **Sweden:** Nearly every second Swedish company answering this question expects that eco-auditing, certification schemes and green R&D programmes will be mandatory. Also eco-labelling is important

In general, a considerable share of the companies returning the questionnaire did not answer this question.

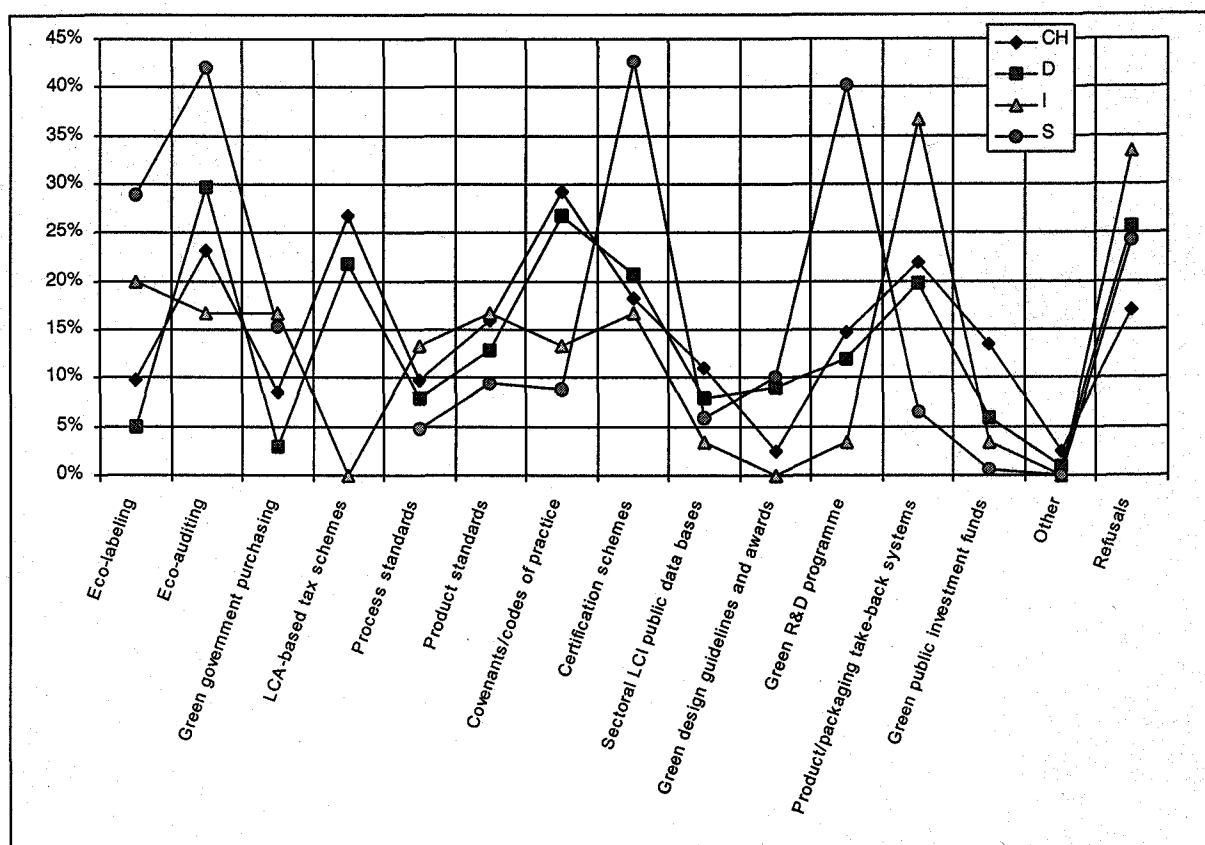


Figure 7.3: Necessary political actions and measures in different countries (relative shares in % of all respondent companies in each country)

However, some tendencies become obvious: Once again, the answers of German and Swiss companies are very close together indicating that a mixture of voluntary measures and of very strong governmental measures is expected to be necessary. The Swedish companies think that especially voluntary measures are necessary; this statement has to be considered within the context of Swedish environmental policy⁵².

The results as to political activities and measures assessed as necessary are very interesting: in all four countries, the voluntary actions of *eco-auditing* and *certification schemes* are particularly important. *Tax-schemes* and *covenants* are preferred in Switzerland and Germany, but rejected in Italy; this might be closely connected with national environmental policies. *Take-back systems* are considered as

⁵² In Sweden, there are several different voluntary eco-labelling systems; environmentally oriented taxes and charges have been introduced (see OECD 1997).

necessary especially in Italy, Germany and Switzerland; however, it is interesting to notice that Swedish companies assess this measure in a very different way. Some actions are considered as hardly necessary, *namely public LCA data bases and green design guidelines*.

7.3 National or European activities?

We also asked if measures should be taken at a specific national or at the European level⁵³. The general tendency is that European actions are preferred. However, exceptions exist: especially German companies prefer national actions with regard to tax schemes, public purchasement and LCA data bases.

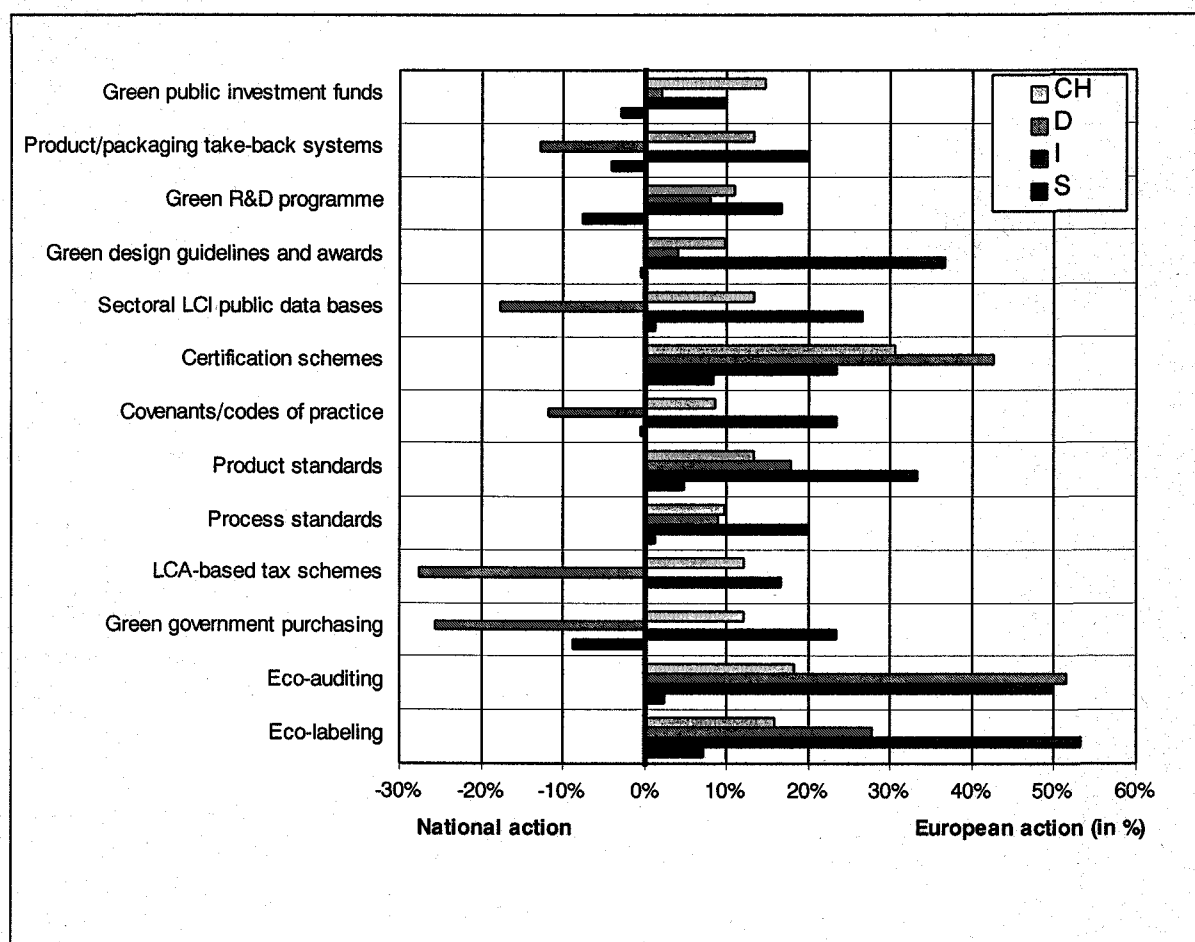


Figure 7.4: Preferences for measures at the national or European level (share of the balance of companies in relation to all answering companies)

⁵³ One must keep in mind that Switzerland is not a member of the European Union.

8 Conclusions

In this chapter, we present general conclusions based on our findings described above.

8.1 Motivations for starting LCA

In general, environmental consciousness seems to be a necessary, but not sufficient condition for starting LCA. This conclusion is based on the observation that environmental concerns are of the higher importance of LCA-using companies in two of the four countries, whereas in two countries concerns are ranked the same independent from the application of LCA. The existence of an environmental management systems seems to be another supporting factor for carrying-out LCA-activities. Especially Swedish companies show a deeper environmental involvement with regard to products and to the introduction of an environmental management system.

Business activities are influenced by a lot of different factors and groups. They are also influenced by stakeholders and the different business areas. Stakeholders are expected to have more influence in the future. Companies using LCA seem to be more influenced by stakeholders than companies which do not use LCA. One might conclude that LCA-companies tend to be more susceptible to external influences. The most important stakeholders are the market and public environmental policies; however, the influence of environmental groups and consumer organisations is perceived higher by companies applying LCA. This leads to the conclusion that external orientation and susceptibility might support the use of LCA. The role of environmental groups and consumer organisations must be taken into consideration; these are especially perceived by LCA-companies. The Italian situation is slightly different because local communities are regarded as important stakeholders; this hints at a direct communication between companies and their surroundings. In Sweden, some stakeholders are also less important for LCA-companies, namely public environmental politics, stockholders, banks/insurances and local communities.

Important drivers for LCA in all countries are cost savings; however, it is interesting to notice that the role of cost-savings as a driver is perceived differently in the four countries: They are mentioned explicitly as a driver in Germany, Italy and Switzerland, but in Sweden cost-savings are indirectly perceived via the future due to liabilities. This is a modest hint at Swedish companies being more proactive oriented than companies in the other countries. Other important drivers are product specific environmental discussions and problems. A specific Italian phenomenon is the huge influence of the international management of mother companies on the use of LCA. Another remarkable finding is the importance of R&D in Sweden which is another hint at the proactive orientation of Swedish companies. For all four countries, the direct influence of the application of LCA by competing companies is not perceived as a driver. Environmental legislation, i.e. political or legal pressures, is not important, especially in Sweden and Switzerland; however, in Germany environmental legislation is ranked near the most important drivers. One might also conclude that a long-term and proactive orientation of companies supports the start of LCA because LCA is able to analyse and describe future problems and risks of products.

8.2 Application patterns of LCA

The analysis of *current* application of LCA shows similar application patterns in Switzerland, Germany, and Sweden and different results in Italy. In the three former countries, the identification of bottlenecks is the most important application of LCA (with a very high peak in Sweden). Another common application in the three countries relates to the external information of consumers and stakeholders. In Italy on the contrary, LCA is mostly used as a rather internal tool for research, development & design activities⁵⁴. This reflects the fact that *today* most Italian companies think that LCA results are still too complicated to be communicated to the public. This might be connected with the fact that LCA in Italy is still rather at an early stage of development.

The application for a comparison of existing products and possible alternatives suggests a more proactive use of LCA in Switzerland and Sweden (see also section 3.3). This is also confirmed by the fact that these two countries have the highest share of companies applying LCA to all new products⁵⁵.

Common to all countries is that at present LCA is *not* used for the two „strategic“ applications, namely for *shift from product to service* and *radical changes in the product life cycle* (with a modest exception of Germany as far as the latter is concerned). The application *assess the gap from eco-label criteria* is rated also very low in all countries. This might be explained by the fact that national eco-label procedures do not necessarily require an LCA, and that the EU eco-label is still not known/applied.

In *future*, only minor changes in application patterns are expected in Sweden (no changes at all in the preference order), Germany, and Switzerland. In the latter country, increased application for *R&D*, *comparisons with products of competitors* and *procurement specifications* are expected.

On the contrary, in Italy a major shift towards more external applications, namely *information and education of consumers and stakeholders* and *procurement specifications, supplier screening, product co-makership* is expected. LCA application for *R&D* is expected to maintain significant, however.

In all countries, and particularly in Italy and Germany, the use of LCA for *radical changes in the product life-cycle* is expected to increase. This might suggest a (very modest) hint at a *future* relationship between LCA and product innovation.

However, *today*, LCA is by far not yet applied as a routine tool for product innovation, and it is still used more in a retrospective than in a prospective way. This is suggested by the common trend in all countries indicating that LCA is mostly used for some existing products, and is clearly *not* used for green products only. In general, it is more frequently applied to existing products than to new products. Moreover, LCA is usually applied to some products and not to all products, demonstrated by the percentage of application of LCA to all new products which is particularly in Germany very low.

8.3 LCA-technique and outlook

In all countries, the officers/departments most involved in LCA are respectively the environmental department, and the one of R&D. Top management follows, with the big exception of Sweden. This

⁵⁴ However, in the other countries also more than 30% of the companies use LCA for this particular application.

⁵⁵ Italian results in this connection do not seem to be particularly reliable, since the answers to the two different questions are rather inconsistent with each other.

might be explained by the fact that Sweden is the country where LCA is most developed and used and/or by a different management culture. In Italy, health&safety officers are significantly more involved than in other countries⁵⁶.

In all countries, LCA are more and more frequently carried out internally involving several departments/functions. In Sweden, the percentage amounts up to 77% of all companies. This suggests that the „internalisation“ and „institutionalisation“ of LCA competences within the company increases with a wider use of LCA.

Clearly, major difficulties are connected with the environmental inventory (collection and quality of data in Italy, Germany and Sweden, definition of boundary system in Italy). Switzerland seems to have a better data collection system, most likely connected with a higher availability of public data. As expected, a large fraction of companies has significant problems with the assessment and interpretation of results in all countries. Interestingly, in Sweden, the problem of costs is much less perceived than in other countries; and what is even more important is that LCA is more a routine tool. LCA users in Swedish companies profit from past experience and from more external support by the state and by research institutes than in the other countries.

In general, most companies expect an increase in LCA-use for the future. Only few companies (with the exception of 23% of Swiss LCA-using companies) think that the use of LCA will diminish. Swedish companies are largely convinced that LCA will further develop on its own. In other countries, many companies expect that the use of LCA will increase, but in connection with other instruments.

The major obstacle to a wider use of LCA in business is the fact that results are disputable. General methodological difficulties are perceived as a significant obstacle in Germany, Italy and Sweden. Interestingly, in no country the costs of the implementation of measures suggested by LCA are considered a main obstacle. This might be connected with the fact that most of the LCAs carried out up to now were rather retrospective/learning LCAs and had not been intended from the beginning for implementation and environmental product innovation purposes.

As already mentioned, costs are perceived as a main problem in Germany and Switzerland, but significantly less in Italy and Sweden. In all countries, most companies think that results of LCA are difficult to be applied immediately and that LCA brings about only long-term benefits.

8.4 Product innovation and LCA

At present, product innovation is driven by marketing, costs and competition. In all countries, environmental pressure is the least relevant factor for pushing product innovation. The most involved departments are the top management and the marketing and sales department. Environmental departments/officers usually do not take regularly part in product innovation processes⁵⁷. Thus, it might be concluded that there is *not* a straightforward connection between LCA and (environmental) product innovation today. This is further confirmed by the fact that only 50%-60% of the LCA companies declare to apply LCA for environmental product improvements. As a matter of fact, the majority of LCA

⁵⁶ In Italy, a new law on health&safety has been established recently. Moreover, environmental officers often cover the health&safety function at the same time.

⁵⁷ Italy seems to be an exception, but this might be due to the double function described in the previous footnote.

carried out up to now were rather retrospective/learning ones.

However, LCA-using companies tend to rank drivers slightly higher, in particular marketing (except of Switzerland) and environmental opportunities (all countries). This suggests a correlation between a more strategic and proactive view of environmental product innovation and the use of LCA. LCA companies also tend to use a larger mix of tools for product environmental assessment and improvement (with the exception of Italy).

As already mentioned, some results presented above, suggest a tendency towards a more prospective use of LCA, which would obviously have major implications for the environmental innovation of products within companies.

8.5 Conclusions with regard to environmental politics and LCA

In general, business considers regulators as one of the most important stakeholders influencing companies. However, differences between companies using and not using LCA are not significant. A look into the future shows the same result. This means that the role and influence of politics on business is not expected to change.

Environmental legislation is not perceived to be among the most important drivers for starting LCA; nor do official eco-labels push significantly LCA-activities.

Political activities and measures affect business. The general tendency is that LCA-companies are affected more than companies not using LCA. At present, important business-affecting measures are certification schemes, covenants and eco-auditing as voluntary measures and product standards and take-back systems as mandatory measures. Especially eco-auditing, LCI-data bases and green design guidelines affect LCA-companies more than companies of the other; these are hints that politically supported voluntary measures are able to stimulate the application of LCA.

The majority of companies tends to prefer voluntary instruments, namely eco-auditing and certification schemes. The other instruments are regarded differently in the companies and countries; clear preferences do not exist. Interestingly, neither public support of LCA by LCI-data bases nor standards (for both products and processes) are regarded as necessary measures. This is a clear signal for the demand for deregulation.

If measures and activities will be taken, companies clearly tends to prefer European to national measures. Only German companies prefer certain national political actions and measures, namely take-back systems, LCI-data-bases, covenants, tax schemes and public purchasement. Particularly eco-auditing and certification schemes, however, should be affected at the European level.

9 Literature

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10. Annexe: Questionnaire used

PART ONE: GENERAL INFORMATION

This is a general part of the questionnaire that refers to the national operating company

- 1.1. Name, and, and position of the person _____
Phone number: _____
Facsimile number: _____
Street: _____
City: _____
E-mail address: _____
Your function and position: _____
- 1.2. Name of the organisation: _____
- 1.3. Is the organisation part of:
☐ a national group
☐ a multinational corporation
- 1.4. Are you filling in the questionnaire from the point of view:
☐ of a single site (specify) _____
☐ of a branch of the company (specify) _____
☐ of the national subsidiary (specify) _____
☐ of an international group (specify) _____
- 1.5. Main products (in terms of sales):

- 1.6. Does the company
☐ mainly sell its products to other industrial companies
☐ mainly sell its products to retail chains
☐ mainly sell its products to end consumer
- 1.7. Number of employees (refer to the point of view of question 1.4.):
☐ below 50
☐ between 51 and 250
☐ between 251 and 500
☐ between 501 and 4999
☐ over 5000
- 1.8. Annual turnover (ECU)..... in the year 199.... (refer to the point of view of question 1.4.)

PART TWO: THE COMPANY AND ENVIRONMENTAL MATTERS

- 2.1. Does the company have
- 2.1.1 *An Environmental Management System (as defined by EMAS, BS7750, ISO 14000)?*
☐ no ☐ no but planned ☐ yes
- 2.1.2 *A Quality System (as defined by BS7550, ISO 14000) ?*
☐ no ☐ no but planned ☐ yes
- 2.1.3 *A risk and Occupational Health and Safety management system?*
☐ no ☐ no but planned ☐ yes

[illegible][illegible][illegible]

2.4. What is in your opinion the strategy of your company? *(Tick one)*

- ☐ compliance
☐ proactive
☐ pioneering and eco-innovator

PART THREE: PRODUCT INNOVATION AND THE ENVIRONMENT

3.1. Which is the stage where product innovation policy is defined in your firm?

(Several answers possible)

corporate strategy
 R & D

process optimisation
 marketing
 other _____

3.2. What are the most important drivers for product innovation in your company?

(Several answers possible)

Drivers	none	low	medium	influential	crucial	don't know
• marketing strategy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
• competitors strategy.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
• cost reduction.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
• legislation pressure	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
• environmental pressures.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
• environmental opportunities.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
• Other drivers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

3.3. Who is normally involved in product innovation programmes definition? *(Several answers possible)*

- ☐ top management
☐ production management
☐ R&D management
☐ product development and design management
☐ environmental officer or department
☐ health and safety officer or department
☐ marketing and sales department management
☐ other _____

3.4. What is the role of the environmental officer and/or **environment**, health and safety department in product innovation process? *(Two answers possible)*

- ☐ initiator
☐ active participant in most cases
☐ occasional consultant
☐ none
☐ other _____

3.5. In the context of product environmental improvements what are the most used tools? *(Several answers possible)*

- ☐ life cycle assessment
☐ checklists
☐ compliance/gap analysis with legislation
☐ material balances
☐ environmental impact assessments
☐ risk assessment (also for health)
☐ energy efficiency analysis and energy balances
☐ none
☐ other _____

PART FOUR: LCA

4.1. Do you use LCA or parts of it?

☐ yes☐ no (go to Part Five)

Please respond to question of this part only if you use or have used life cycle assessment (LCA) or parts of it otherwise go to Part Five.

4.2. Which of the following factors pushed in most occasions forward the decision to start LCA in your company? (Please mark each of the following level of importance according to this scale.)

Factors	none	low	medium	influential	crucial	don't know
• Product environmental problems	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
• Willingness to respond to emerging green markets	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
• Collaborative study with external organisations (ex. Industry associations, consultants, research institutes).....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
• Decision expressed by the management to examine some areas	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
• Meet eco label criteria	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
• Encouragement from the parent company	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
• Competitors who started to use it.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
• Willingness to introduce new analysis instruments for R & D	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
• Evolution of environmental legislation - ex. Packaging Directive	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
• Cost savings opportunities/efficiency	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
• Cost avoidance due to future liabilities.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
• Initiatives by research/technical departments	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
• Perceived environmental discussions (Agenda 21,).....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
• Other	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

4.3. What are the most **frequent** applications of LCA? (tick up to 4 choices)

- ☐ radical changes in product life cycle
- ☐ bottlenecks identification
- ☐ anticipate and negotiate legislation
- ☐ research development and design
- ☐ procurement specifications, supplier screening, product co-makship and stewardship
- ☐ information and education to consumer and stakeholders
- ☐ environmental cost allocation
- ☐ compare existing company products with products of competitors
- ☐ compare existing products with planned alternatives
- ☐ assess the gap from eco-label ecological criteria
- ☐ shift from product to service
- ☐ define marketing and advertising policies and join eco-labelling criteria
- ☐ internal (to the company) information and training
- ☐ other

4.4. Do you use LCA? (*tick up to 2 choices*)

- ☐ for some existing products
- ☐ for all existing products
- ☐ only for green products
- ☐ for some new products?
- ☐ for all new product?
- ☐ other _____

4.5. Which functions have been involved in LCA? (*Several answers possible*)

- ☐ top management
- ☐ production management
- ☐ R&D function
- ☐ product development and design function
- ☐ environmental officer
- ☐ health and safety officer
- ☐ purchasing department
- ☐ marketing and sales department management
- ☐ other _____

4.6. Who performs LCA-studies?

- ☐ internal teams
- ☐ external consultants and/or research institutions
- ☐ jointly performed with other companies and industry associations
- ☐ other _____

4.7. Mark the main methodological difficulties the company have met in implementing LCA? (*Several answers possible*)

- ☐ methodology complexity
- ☐ definition of system boundaries
- ☐ collection and quality of data (in the inventory phase)
- ☐ difficulties in the assessment and interpretation phase
- ☐ cost of resources involved
- ☐ other _____

4.8. Mark the main obstacles, if any, to a wider use of LCA in the company:
(*Several answers possible*)

- ☐ results are disputable
- ☐ results are difficult to be communicated by top management
- ☐ general methodological difficulties
- ☐ costs of LCA
- ☐ cost of implementation of measures suggested by LCA findings
- ☐ other _____

4.9. What is the balance between costs and benefits of LCA?

- ☐ LCA provides results that can be immediately applied
- ☐ LCA benefits are long term ones
- ☐ benefits of LCA are strictly related to the use of results in the company
- ☐ benefits depend upon the possibility of diffusing results externally
- ☐ other: _____

4.10. Did LCA produce any surprise?

- ☐ yes, please specify _____
- ☐ no
- ☐ do not know

4.11. Do you think the use of LCA will increase in the future in your company?

(Several answers possible)

- ☐ yes
☐ no
☐ only if used together with other instruments
☐ only if methodology will be clearer
☐ depending on the spread of the instrument among companies
☐ other: _____

4.12. If yes (question 4.11): what are the most promising applications of LCA?

(tick up to 4 choices)

- ☐ radical changes in product life cycle
- ☐ bottlenecks identification
- ☐ anticipate and negotiate legislation
- ☐ research development and design
- ☐ procurement specifications, supplier screening, product co-makeship and stewardship
- ☐ information and education to consumer and stakeholders
- ☐ environmental cost allocation
- ☐ compare existing company products with products of competitors
- ☐ compare existing products with non existing alternatives
- ☐ assess the gap from eco-label ecological criteria
- ☐ shift from product to service
- ☐ define marketing and advertising policies and join eco-labelling criteria
- ☐ internal (to the company) information and training
- ☐ other

PART FIVE: FUTURE ENVIRONMENTAL PUBLIC POLICY IN THE AREA OF PRODUCT

The following questions refer to present and future environmental policies

5.1. In which way do **present** Government policy actions listed in the table are affecting your way to do business? *(Several answers possible)*

[illegible]

5.2. What do you expect to be the **future (5 years)** policy actions related to LCA and affecting your way to do business?

(Use the following table marking)

- the likelihood to occur (1 = none; 2 = low; 3 = medium; 4 = influential; 5 = crucial; 0 = don't know)
- the importance for your business (1 = none; 2 = low; 3 = medium; 4 = influential; 5 = crucial; 0 = don't know)
- and tick where you think the action will take place (European or National)

Environmental policy action	Likelihood to occur						Affecting your business						Europe an action	National action
a) eco-labelling	1	2	3	4	5	0	1	2	3	4	5	0		
b) eco-auditing	1	2	3	4	5	0	1	2	3	4	5	0		
c) green government purchasing	1	2	3	4	5	0	1	2	3	4	5	0		
d) LCA based tax schemes	1	2	3	4	5	0	1	2	3	4	5	0		
e) process standards	1	2	3	4	5	0	1	2	3	4	5	0		
f) product standards	1	2	3	4	5	0	1	2	3	4	5	0		
g) covenants and sector codes of practice	1	2	3	4	5	0	1	2	3	4	5	0		
h) certification schemes	1	2	3	4	5	0	1	2	3	4	5	0		
i) sectoral LCI public data bases	1	2	3	4	5	0	1	2	3	4	5	0		
j) green design guidelines and awards	1	2	3	4	5	0	1	2	3	4	5	0		
k) green publicly funded R&D programme	1	2	3	4	5	0	1	2	3	4	5	0		
l) product and packaging take-back systems	1	2	3	4	5	0	1	2	3	4	5	0		
m) green public investment funds	1	2	3	4	5	0	1	2	3	4	5	0		
n)	1	2	3	4	5	0	1	2	3	4	5	0		

5.3. Which of the above mentioned (question 5.2.) will be mandatory in your opinion? (use letters) _____

5.4. Do you think that actions undertaken by your company are sufficient to be ready or you will need to be more active in environmental management?

☐ yes

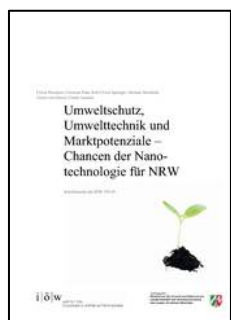
☐ no

☐ partly, please explain _____

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