



## Developing the Social Life Cycle Assessment

- addressing issues of validity and usability

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*Publication date:*  
2010

*Document Version*  
Publisher's PDF, also known as Version of record

[Link back to DTU Orbit](#)

*Citation (APA):*  
Jørgensen, A. (2010). *Developing the Social Life Cycle Assessment: - addressing issues of validity and usability*. DTU Management. PhD thesis No. 15.2010

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# Developing the Social Life Cycle Assessment

- addressing issues of validity and usability

Andreas Jørgensen

PhD Thesis, February 2010

**Developing the Social Life Cycle Assessment  
- addressing issues of validity and usability**

PhD thesis, November 2010  
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Print: Schultz Grafik A/S

- *Why do you want to develop a new manipulation tool?*

[Asked when presenting the idea of developing the Social Life Cycle Assessment to a potential supervisor at the Copenhagen Business School]



## Summary

This thesis seeks to add to the development of the Social Life Cycle Assessment (SLCA), which can be defined as an assessment method for assessing the social impacts connected to the life cycle of a product, service or system. In such development it is important to realise that the SLCA is only appealing to the extent that it does what it is supposed to do. In this thesis, this goal of SLCA is defined as to support improvements of the social conditions for the stakeholders throughout the life cycle of the assessed product, system or service. This effect should arise through decision makers following the 'advise' of the assessment. In order for a positive effect to arise from following a decision, the preferred alternative has to be associated with more favourable social impacts than the other assessed alternatives, indicating that the assessment has to validly represent the consequences of each alternative. But to create an effect, validity is not enough; the SLCA furthermore has to be usable in a decision making context. It has been the aim of this thesis to identify the issues which may hinder the validity and usability of the SLCA and to propose procedures to incorporate in the SLCA alleviating the problems.

With regards to the usability of SLCA, a study was conducted addressing 8 Danish companies' interest and possibility in using SLCA. Here it was shown that the interest in SLCA was limited to external purposes, most notably comparative assertions for marketing purposes. However, it was also shown that the companies' ability to obtain data throughout their products' life cycles was very limited, for example because suppliers were unwilling to hand over this information to the companies or because the goods were bought on open markets furnished by a large number of unidentified suppliers. These issues were found to potentially limit the use of SLCA in companies to applications with very limited life cycle perspective. Mitigation of this data availability problem may show to be very difficult for companies, since the only way seem to be to lower the demand for the validity of the data included in the SLCA. If the SLCA is then used for external purposes, the company would run the risk of taking credit for the results given by a potential untrue assessment, which, if being the case and later discovered, may be highly incriminating for the company. It is furthermore discussed that other user groups, such as governments and intergovernmental organisations, may have other demands for SLCA and therefore also other possibilities. The usability of SLCA is only addressed in this study, whereas the three consecutive studies focus on the validity of SLCA. The reason for this overemphasis on validity is that the usability inevitably will be addressed in the development of SLCA, whereas this is not the case with regards to validity.

The first of these studies addresses the validity of impact pathways in SLCA, which denotes the cause effect relationship between indicator and the 'Area of Protection' (AoP), representing the underlying issue of importance assessed in the SLCA. The study is based on two examples from the existing work on SLCA: One considers whether the type of indicators included in SLCA approaches can validly assess impacts on the one of the two definitions of AoPs in SLCA, being the well-being of the stakeholder, and the other example addresses whether the 'incidence of child labour' is a valid indicator to assess impacts on the AoPs. Both examples show a poor validity of the impact pathways. The first example shows that depending on the definition of 'well-being' the assessment of impacts on the well-being of the considered stakeholder can not be performed exclusively with the objective indicators which are presently used in SLCA approaches. Objective indicators are indicators designed to measure impacts which can, at least potentially, be measured without the involvement of the impacted stakeholder. If well-being is understood as something pertaining to the experience of the individual, subjective indicators are needed, which are indicators that focus on the experiences or feelings of the impacted stakeholder.

The second example shows that the mere fact that a child is working tells little about how this may damage or benefit the AoPs, implying that the normally used indicator; ‘incidence of child labour’ lacks validity in relation to predicting damage or benefit on the AoPs of SLCA. More valid indicators should rather focus on, among others, the health impacts of child labour and its impacts on schooling outcomes. However, even though the indicators proposed in both examples may improve the validity of the assessment, a problem is that in both cases, the indicators demand more detailed data, which may limit their usability.

The second study begins by considering that the SLCA as presented here should assess the consequences of a decision. This can be expressed as the difference between how the world is or will be because of the decision and how the world would look like had it not been for this decision. At this point it is important to realise that social impacts on individuals do not only happen in product life cycles, but in all aspects of their life. Thus, if a decision implies that a worker participates in a product life cycle, the worker will, if the decision is not taken, have to do something else, which will equally impose some impacts on him or her.

When assessing the consequence of a decision for the worker it is thus this difference between these two situations, the ‘implemented’ vs. the ‘non-implemented’ decision which should be considered. More or less same argument goes for the product user. The study attempts to model the impacts of the ‘non-implemented’ decision in relation to the worker and the product user and finds that when the non-implemented decision situation means that the product is not produced at all, it is often associated with increased levels of unemployment. Literature on unemployment suggests that unemployment causes decreased health levels, increased poverty, family tension and violence and crime, but that the impacts may vary with context of the unemployed. If the non-implemented decision implies that a product user will no longer use a product the non-implemented decision may lead the user to choose another products associated with another life cycle and thereby other social impacts or choose to spend his or her time on something not related to product life cycles, which will equally impose social impacts on the user.

The assessment of the impacts of the non-implemented decision is discussed and found to be difficult due to the complexity of identifying what this non-implemented situation amounts to. However, it is argued that some relatively simple assessments may be performed which may still improve the validity of the assessment in comparison to simply ignoring the impacts of the non-implemented decision, however inaccurate they may be.

The third and unfinished study addresses the possible influence of the context on the validity of SLCA. Here two examples are analysed. One relating to the context variability of proposed endpoint categories in SLCA where it is shown on the basis of literature that what influences the well-being of the individual (one of the suggested AoPs in SLCA) differs across respondents and geographical groups, implying that the importance of the various suggested endpoint categories varies with context.

The second example addresses the data collection procedures through social audits. Through an interview with a social auditor it is suggested that the auditor varies the procedures for carrying out the audit in order to get the most valid result. For example, the auditor has to take into account the various tricks a company in a given context normally uses to cheat the auditor. However, this conclusion is based on only one interview and must therefore be considered as uncertain. Both cases thus points to that context plays a role for how the methodology in relation to endpoint categories and data collection procedures needs to take account of the context in order to get a valid assessment and it is therefore argued that not only may data be site-specific in SLCA, so may methodology if the context variation should be accounted for.

The results of the studies addressing the problems of validity in SLCA all suggest measures of improvement which entail more laborious, and thereby probably also less usable, assessments, whereas the study addressing usability concludes that from a company perspective a less laborious approach is needed. It thus seems that there is a trade-off between validity and usability and it is therefore discussed to what extent compromises can be made. Here it is argued that different users may be imagined who may have different possibilities and demands in terms of requirements to work and validity of the assessment and that several different SLCA approaches should be available fitting these different possibilities and demands to increase the overall use of SLCA. However for all of these different approaches it is argued that the assessment should as a minimum be more accurate than no assessment at all. If this is not the case, SLCA can hardly be regarded as decision support. This minimum requirement is discussed in more detail and it is found that while inclusion of other measures proposed for increasing the validity of SLCA is for the user of the SLCA to decide, the assessment of the impacts of both the implemented and non-implemented life cycle situations, addressed in the second validity related study, must always be included. However, since this validity demand only establishes very few requirements to the user, this methodological 'openness' may potentially be used to consciously select indicators or data in favour of one alternative. To mitigate this possibility for manipulation, a more comprehensive demand is considered which is to always include an assessment of the completeness and uncertainties in SLCA accessible to the public. This, however, requires knowledge about how certainty and completeness is established in SLCA, calling for further studies into the validity of SLCA procedures. Several studies addressing this issue are proposed. A final discussion summarises the findings and concludes that due to raised difficulties in SLCA about data availability and issues like the assessment of the non-implemented decision, SLCA may never gain the same popularity as ELCA.



## Resumé

Denne afhandling søger at bidrage til udviklingen af den sociale livscyklusvurdering (SLCA), som kan defineres som en vurderingsmetode til at vurdere de sociale påvirkninger knyttet til produkter, services og systemers livscyklus. Når man går i gang med en sådan udvikling, er det vigtigt at holde sig for øje, at udviklingen af SLCA kun er interessant i det omfang, metoden opfylder sit mål. I denne afhandling er målet blevet defineret til, at SLCA skal kunne forbedre de sociale vilkår for de interessenter, som bliver påvirkede af det vurderede produkt, system eller services livscyklus. Denne effekt skal opnås ved, at beslutningstageren følger vurderingens 'råd'. For at en positiv effekt kan ske ved at følge et råd, skal det alternativ, som bliver valgt af beslutningstageren føre til mere favorable sociale konsekvenser end de andre vurderede alternativer som beslutningen står imellem. Dette indikerer, at vurderingen skal repræsentere konsekvenserne for hvert alternativ så validt som muligt. Men for at den ønskede effekt kan opstå er validiteten af vurderingen ikke nok; vurderingen skal også være brugbar i en beslutningskontekst. Målet for denne afhandling er derfor at identificere emner, som kan hindre brugbarheden og validiteten af SLCA og at foreslå procedurer til at afhjælpe disse problemer.

For at adressere brugbarheden af SLCA blev 8 danske virksomheder interviewet omkring deres interesse i og mulighed for at bruge SLCA. Dette studie viste, at interessen for SLCA var begrænset til eksterne formål, især komparative analyser til brug i markedsføring. Det blev dog også konkluderet, at virksomhedernes muligheder for at skaffe de nødvendige data om deres produkters livscyklusser var meget begrænsede, for eksempel fordi leverandører ikke var villige til at udlevere data til de interviewede virksomheder, eller fordi varerne var købt på åbne markeder med et stort antal uidentificerede leverandører. Dette vil potentielt begrænse brugen af SLCA i en virksomhedssammenhæng til applikationer med meget begrænset livscyklusperspektiv. Det kan være vanskeligt at afhjælpe dette problem, da den eneste måde synes at være at sænke kravene til validiteten af data, der indgår i SLCA. Hvis en virksomhed benytter en sådanne data til eksterne formål, vil virksomheden løbe den risiko at markedsføre sig på forkert grundlag, som hvis det bliver opdaget, kan være stærkt belastende for virksomheden.

Derudover bliver det diskuteret, at andre brugergrupper, såsom regeringer og mellemstatslige organisationer, kan have andre krav til SLCA og derfor også andre muligheder.

Brugbarheden af SLCA er kun adresseret i dette ene studie. De følgende tre studier fokuserer på validiteten af SLCA. Grunden til dette større fokus på validiteten er, at brugbarheden af SLCA uundgåeligt vil blive berørt under udviklingen af SLCA, hvorimod dette ikke er tilfældet med hensyn til validiteten.

Det første studie beskæftiger sig med validiteten af de årsagssammenhænge, som antages at være mellem indikatorer og AoP ('Area of Protection'), som repræsenterer det grundliggende område, der måles på i SLCA. Studiet er baseret på to eksempler fra eksisterende SLCA metodeforslag: Et eksempel handler om, hvorvidt foreslåede indikatorer validt kan vurdere påvirkninger af interessenters velvære, som er en af to definitioner af AoP i SLCA. Det andet eksempel analyserer, om 'forekomsten af børnearbejde' er et validt mål for påvirkninger af SLCAs AoP'er. Begge eksempler viser en mangel på validitet af de antagne årsagssammenhænge. Det første eksempel viser at afhængigt af definitionen på velvære, kan påvirkninger af interessenter ikke måles udelukkende ved at bruge objektive indikatorer, som anvendes i de eksisterende SLCA metoder. Objektive indikatorer er indikatorer beregnet til at måle påvirkninger, der potentielt kan måles uden inddragelse af den berørte interessent. Hvis velvære forstås som noget, der vedrører individets oplevelse, er subjektive indikatorer nødvendige. Subjektive indikatorer fokuserer på, hvordan individet oplever påvirkningen.

Det andet eksempel viser, at den omstændighed at et barn arbejder fortæller meget lidt om, hvordan AoP'erne bliver påvirket, hvilket indebærer, at 'forekomsten af børnearbejde', som er den normalt anvendte indikator for børnearbejde, mangler validitet i forhold til at kunne måle effekten på AoP'erne. Derimod vil indikatorer, som fokuserer på bl.a. de sundhedsmæssige virkninger af børnearbejde og dets indvirkning på barnets skolegang give mere valide resultater. Men selv om de indikatorer, der foreslås i begge eksempler kan forbedre validiteten af vurderingen, kræver disse indikatorer mere detaljerede data, hvilket kan begrænse indikatorernes anvendelighed.

Det andet studie tager udgangspunkt i, at SLCA, som den bliver præsenteret her, skal vurdere konsekvenserne af en beslutning relateret til produkt livscyklusser. Dette kan udtrykkes som forskellen mellem, hvordan verden er eller vil blive som følge af beslutningen, og hvordan verden ville se ud, hvis det ikke havde været for denne beslutning.

Sociale konsekvenser for individer forekommer ikke kun i produktets livscyklus, men i alle situationer af den berørtes liv. Hvis en beslutning leder til, at en arbejder bliver inddraget i en produktlivscyklus, vil arbejderen, hvis beslutningen ikke bliver taget, blive nødt til at gøre noget andet. Dette andet vil ligeledes have konsekvenser for ham eller hende. Konsekvensen af en beslutning er således forskellen mellem disse to situationer; den 'implementerede' og den 'ikke-implementerede' beslutning. Samme argument får betydning for produktbrugeren, som ligeledes må gøre noget andet hvis denne ikke bruger produktet. Studiet forsøger at analysere virkningerne af den 'ikke-implementerede' beslutning i forhold til arbejderen og produktbrugeren og konkluderer, at når den ikke-implementerede beslutningssituation betyder, at produktet ikke bliver fremstillet, er det ofte forbundet med øget arbejdsløshed. Litteratur om arbejdsløshed viser, at arbejdsløsheden ofte leder til dårligere fysisk og psykisk helbred, øget fattigdom, familiespændinger, vold og kriminalitet, men at disse konsekvenser varierer alt efter konteksten.

I forhold til produktbrugeren vil den ikke-implementerede beslutning medføre, at produktbrugeren ikke længere vil bruge produktet, hvilket leder til, at brugeren enten vælger et andet produkt, som vil udsætte brugeren for andre påvirkninger og være forbundet med en anden livscyklus, eller brugeren kan vælge at bruge sin tid på noget, der ikke relaterer til produkter, hvilket også vil have konsekvenser for brugeren.

At vurdere påvirkningerne af den ikke-implementerede beslutning bliver fundet vanskelige, da det viser sig problematisk at identificere, hvad denne situation leder til for arbejderen og produktbrugeren. Det konkluderes dog, at nogle relativt simple analyser kan udføres, som stadig kan forbedre validiteten af vurderingen i forhold til blot at ignorere konsekvenserne af de ikke-implementerede beslutning.

Det tredje og uafsluttet studie adresserer kontekstens mulige indflydelse på validiteten af SLCA. To eksempler bliver diskuteret. Et ser på variationen af, hvordan AoP bliver påvirket i forskellige kontekster. Her bliver det påvist på baggrund af litteraturstudier, at hvad der er vigtigt for den enkeltes velvære, som er en af de foreslåede AoP'er i SLCA, adskiller sig på tværs af individer og geografiske områder, som dermed indikerer, at det foreslåede AoP er kontekstafhængigt.

Det andet eksempel omhandler indsamlingen af data igennem såkaldte sociale audits. Et interview med en auditor sandsynliggør, at auditører varierer procedurerne for udførelsen af auditet for at få et så validt resultat som muligt. For eksempel tog den interviewede auditor i sin procedure højde for de forskellige tricks en virksomhed i en given kontekst normalt brugte for at snyde auditøren.

Konklusion er dog kun baseret på et interview, og må derfor betragtes som noget usikker.

I begge tilfælde er det påvist, at konteksten spiller en rolle for validiteten af vurderingen, og der bliver derfor argumenteret for, at denne variation bør inkorporeres i SLCA.

Resultaterne fra disse studier omhandlende validiteten af SLCA peger alle på ændringer, som vil gøre SLCA mere arbejdskrævende at bruge, hvilket antageligt også vil føre til en mindre brugbarhed af SLCA. Samtidig peger studiet af SLCAs brugbarhed på, at der er behov for en mindre krævende SLCA. Det ser derfor ud som om, at en afvejning mellem graden af validitet og brugbarhed af SLCA er nødvendig. I forlængelse heraf bliver det diskuteret, hvordan kompromisser mellem disse krav kan nås. Som tidligere nævnt kan forskellige brugere af SLCA have forskellige muligheder for at anvende SLCA og varierende krav til validiteten af vurderingen, hvilket indikerer, at flere SLCA metodologier bør laves, således at de passer til forskellige muligheder og krav for derved at øge den samlede brug af SLCA. Dog bliver der argumenteret for, at et minimumskrav til validiteten af vurderingen må være, at vurderingen skal være mere nøjagtig end det tilfældige valg. Hvis dette ikke er tilfældet, kan SLCA næppe ses som et beslutningsstøtteværktøj. På basis af dette minimumskrav bliver det konkluderet, at det er nødvendigt altid at inkludere vurderingen af både den implementerede og den ikke-implementerede beslutning i SLCA, hvorimod inkluderingen af alle de andre forslag til forbedringen af validiteten af vurderingen kan besluttes af brugeren af SLCA. Disse meget løse krav til vurderingen kan dog føre til et bevist valg og fravalg af data og indikatorer for at favorisere et beslutningsalternativ. For at mindske denne risiko for manipulation er det foreslået, at en vurdering af SLCA's fuldstændighed og sikkerhed altid bør medtages, hvis denne er offentligt tilgængelig. Dette kræver dog, at man har viden om, hvordan fuldstændighed og sikkerhed er opnået i en SLCA, hvilket peger på flere studier af validiteten af SLCA metodikken. Flere studier som adresserer dette emne er foreslået.

En afsluttende diskussion opsummerer resultaterne og konkluderer, at på grund af de nævnte vanskeligheder med SLCA blandt andet i forhold til tilgængeligheden af data og vurderingen af den ikke-implementerede beslutning, vil SLCA måske aldrig nå samme popularitet som ELCA.

## **Preface**

The idea for this thesis was born in a supermarket out of confusion. Confusion about whether to choose biodynamic bananas over fair trade and about whether to go for the EU flower labelled rather than the allergy-friendly shampoo in order to buy the product which was doing 'the most good'. As a response I imagined a label condensing all of these concerns into one, allowing the consumer to choose more easily, and hopefully pushing the producer to 'make better products'. My interest in the idea grew and being a student of the Technical University of Denmark and having had a course in 'life cycle assessment', it was obvious to me from the start that when being interested in such a complete overview of the consequences of a product, the life cycle perspective was essential. I therefore in the spring 2006 contacted Michael Hauschild, my previous teacher in the life cycle assessment course, and aired the idea of working with the development of such a label in a PhD project. His response was positive, but he argued that in order to develop such label it was necessary to have a well founded methodological basis. On the environmental area, he argued, such methodology already existed manifested in the relatively established (environmental) life cycle assessment (ELCA), but since my idea was also to include aspects related to the 'human living conditions' in the label, the focus should be on developing a methodological basis for the assessment of these 'human costs'; a social life cycle assessment (SLCA) in contrast to the existing ELCA. I agreed to this approach and in the matter of a few days we had arranged an application for a university funded PhD scholarship which was granted during the summer 2006.

The result of this PhD scholarship is this thesis, which because of shifts in focus did not come to relate specifically to the labelling situation but to the development of SLCA in a more general sense.

Apart from a few chapters and discussions not previously presented, this thesis is more or less a summary of main findings in the published and submitted articles where I have been the first author written during the project, presented here as a coherent whole. With this focus and due to the limited length of the thesis, the findings in the articles are presented in a very short form where some discussions given in the articles have been shortened or in some cases left out. The articles are presented in their entirety in the appendices 2 to 5. A complete overview of articles and conference presentations to which I have contributed during the PhD project is given in appendix 1.

The PhD project was performed in the period from September 2006 to February 2010, including 6 months of leave to participate in an EU project.

I would like to thank my two supervisors Michael Hauschild and Michael S. Jørgensen, both from the Department of Management Engineering at the Technical University of Denmark. Also, I would like to thank the Department of Environmental Technology at the Technical University of Berlin, especially Marzia Traverso, Anne Lehmann and Matthias Finkbeiner, for a motivating and in all regards fantastic stay in the period from July 2009 to October 2009.

Kgs. Lyngby, February 3<sup>rd</sup> 2010

Andreas Jørgensen



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# 1 Introduction

Since the environmental movement in the 60's it has been increasingly clear due to man's increasing number and technological power that nature could no longer be seen as having infinite resources and being an infinite sink for waste and emissions. To ensure mankind's continued welfare it was obvious that some degree of control was needed with the goal of ensuring that not only should present generations be able to meet their needs, future generations should as well, as it was formulated in the Brundtland Report (Brundtland 1987). Our development should in other words be sustainable, and ensuring the availability of the natural resources for future generations was here seen as a key concern. But evidently mankind's welfare is not only dependent on natural resources; it is also dependent on well-functioning societies. Thus, nature cannot be seen as the only resource, the functioning of society can equally be seen as a resource to preserve or enhance, and accordingly the idea arose that sustainability has three dimensions, which besides an environmental dimension includes a social and economical dimension, representing the resources in society. Going from this theoretical level to a more practical, to plan for a sustainable development we are faced with the need to make decisions taking us in a more sustainable direction. As a response to this the environmental life cycle assessment (ELCA) has been developed. The ELCA is as its name suggests a life cycle oriented environmental assessment methodology<sup>1</sup> focused on products, system or service (from here on simply termed 'products') meaning that it is an assessment methodology which attempts to include all material inputs and outputs to and from the assessed product from its cradle (often material extraction) over product production, and use to its grave (disposal). Based on this inventory of material inputs and outputs and knowledge of the various inputs' and outputs' impact on the environment an environmental 'profile' of the product can be made, illustrating the environmental impacts the product will have throughout its life cycle, enabling the decision maker to choose solutions resulting in fewer environmental impacts than the alternatives (for more information on ELCA, see for example Wenzel et al. 1997).

But based on the assumption that sustainable development is not only about preserving the environment but also the social and economical resources, the idea arose to develop parallel product assessment methodologies on these areas.

The overall idea behind this study is to contribute to the development of the methodology for assessing the social 'costs' of a product's life cycle. However, in the last 5 years there has been an increased interest in the development of such a methodology, often named the social life cycle assessment (SLCA). The development undertaken in this study therefore does not start from scratch but rather builds on existing work. In the following an overview of this existing work on the development of SLCA will be given. The overview is primarily based on Jørgensen et al. (2008), which can be seen in its entirety in appendix 2.

## 1.1 What is the SLCA?

SLCA can be characterised as a methodology, or in other words some procedural steps, which if followed leads to an assessment of the social impacts of a product over (parts of) its life cycle. With some small variations, the SLCA is in literature considered to include more or less the same procedural steps as an ELCA, outlined in the ISO 14044 (2006) which is the international standard for performing an ELCA, including a goal and scope definition, inventory analysis, an impact assessment and an interpretation. Much can be said about each of these phases, but in short the purpose of each of these is as follows:

- The goal definition addresses what is to be assessed and why the assessment is performed.

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<sup>1</sup> Much in line with the LCA tradition, 'methodology' will here be understood a series of procedural steps which may be followed to obtain a specific result. Methodology, tool and approach will thus here be used interchangeably.



- The scope definition addresses the choices made in order to perform the assessment and the limitations of the assessment.
- The purpose of the inventory analysis is to collect the data as outlined through the goal and scope definition
- In the impact assessment, the inventory data is through models ‘translated’ into impacts.
- In the interpretation the outcome of the previous phases in accordance with the goal definition of the study

In the following it will be outlined in more detail how the various SLCA approaches have addressed; the setting of systems boundaries and selection or definition of impacts to include in relation to the scope definition; in relation to the inventory assessment how the data is to be collected; and in relation to the impact assessment how inventory data is translated into impacts. The merits and shortcomings of the presented approaches will not be discussed here. In Jørgensen et al. (2008) (appendix 2) several other issues have also been addressed, which due to the lack of relevance for this thesis have been omitted here.

### **1.1.1 System boundaries**

As mentioned, SLCA assesses a product’s life cycle, but since a life cycle in principle is infinite there is in SLCA a need for establishing boundaries for the system to assess<sup>2</sup>. Two different suggestions are given to this issue: With the goal to support management decisions, the approaches presented by Méthot (2005) and Dreyer et al. (2006) narrow their focus to those parts of the life cycle that the company performing the assessment can influence directly. The application of the SLCA thereby justifies that only the company and its closest suppliers and distributors are assessed. Another approach has been to in principle include the entire life cycle, but preclude processes that do not significantly change the overall conclusions of the study (Weidema 2005; Spillemaekers et al. 2004; Barthel et al. 2005).

### **1.1.2 Area of Protection, impact categories and indicators**

When assessing the social impacts associated to a product’s life cycle, there are several elements which need to be considered. First of all there is a need to consider what is meant by social impacts. This has in existing work on SLCA been defined and delimited by the definition of the so-called Area of Protection (AoP)<sup>3</sup> which denotes underlying themes of concern the assessment centres on. The AoP of SLCA has by Dreyer et al. (2006) and Weidema (2006) been defined quite unanimously as everything affecting ‘human health and well-being’. Schmidt et al. (2004) on the other hand propose ‘societal wealth’. But in both cases, the AoP is a rather abstract phenomenon and it is evident that to perform an SLCA something more concrete and operational is needed. As a response to this, most of the publications on SLCA include a list of more concrete social issues to address in the SLCA, often termed impact categories, which in some cases are further operationalised into social indicators. The impact categories can, depending on their ‘location’ in relation to the impact pathways be at both midpoint and endpoint. For example, the impact category job creation is normally not considered a goal in itself, but through contributing to the family income and subsequent poverty reduction it may improve the family’s health conditions, which may be considered as an end goal. In this example, the job creation could thus be considered being at midpoint level, whereas health condition at endpoint. Both are included in the tables below:

<sup>2</sup> Other possibilities are given in input-output LCA. IO-LCA has also very recently been applied to SLCA, see Andrews et al. (2009).

<sup>3</sup> AoP is a term originally defined in environmental LCA to represent the classes of environmental endpoints that society wants to protect (Udo de Haes et al. 1999)

Impact categories at midpoint level	Included in											
	Barthel et al.	Cañeque	Dreyer et al.	Flysjö	Gauthier	Hunkeler	Manhart & Grieghammer	Méthot	Nazarkina & Le Bocq	Schmidt et al.	Spillemeckers	Included in approaches
<b>Human rights</b>												
Non-discrimination	X	X	X	X	X		X	X	X	X	X	10
Freedom of association and collective bargaining	X		X	X			X	X	X	X	X	8
Child labour	X		X	X			X		X	X	X	7
Forced and compulsory labour	X		X	X			X		X	X	X	7
<b>Labour practices</b>												
Wages	X	X		X			X	X	X	X	X	8
Benefits, including family support for basic commodities and workforce facilities				X		X	X		X	X		5
Physical working conditions	X	X	X	X	X		X	X	X	X	X	10
Psychological and organisational working conditions				X	X		X		X	X	X	6
Training and education of employees		X		X	X		X	X	X	X	X	8
<b>Society</b>												
Corruption					X		X		X	X		4
Development support and positive actions towards society	X			X			X	X	X	X	X	7
Local community acceptance					X			X	X	X	X	5
Ensuring of commitment to sustainability issues from and towards business partners							X				X	2
<b>Product responsibility</b>												
Integration of customer health and safety concerns in product				X	X					X	X	4
Information about product to users										X	X	2
Ethical guidelines for marketing										X		1

**Table 1:** Overview of impact categories at midpoint level proposed in existing SLCA literature. The table is based on Jørgensen et al. 2008.

Impact categories at endpoint level	Included in	
	Norris	Weidema
Mortality		X
Morbidity	X	X
Autonomy		X
Safety, security and tranquillity		X
Unequal opportunities		X
Participation and influence		X

**Table 2:** Overview of impact categories at endpoint. The table is based on Jørgensen et al. 2008.

### 1.1.3 The collection of data

Having established the impact categories and indicators needed to perform the assessment, data is needed throughout the assessed life cycle for each of the indicators included. A debate which arose at this point was that contrary to ELCA, where it is generally accepted that the environmental

impacts arise mainly because of the nature of the processes that occur in the life cycle<sup>4</sup>, Spillemaeckers et al. (2004) and Dreyer et al. (2006) claimed that social impacts as the ones proposed above have no relation to the processes themselves but rather to the conduct of the companies performing the processes. In other words, it is often assumed that there is a causal link between process and environmental impact, but for social impacts it is argued that the causal link is not from process to social impact, but from conduct of the company to the social impact. This implies that two companies producing exactly the same products and, based on the argument above, having comparable environmental impacts can have completely different resulting social impacts making the use of generic process related data as used in ELCA irrelevant or at best very uncertain to apply. Dreyer et al. (2006) and Spillemaeckers et al. (2004) argue instead that until frequently updated databases on the conduct of the companies included in the life cycle is available, site specific data has to be collected. Spillemaeckers et al. (2004) nuance this view by arguing that risk assessments of each company or other stakeholder included in the life cycle can be performed to reduce the work load of collecting site specific data for the whole life cycle. Other scholars on the other hand maintain the process oriented approach in SLCA as a basis for the data collection (see e.g. Barthel et al. 2005)

#### **1.1.4 Impact assessment**

As can easily be imagined an assessment utilising in some cases more than 50 different social indicators related to very different impact categories, as illustrated in table 1 and 2 above, will easily result in a rather obscure result on which it may be difficult to base any decision. A more comprehensible assessment of the impacts may thus be needed, and different approaches have been opted for by various scholars. From an overall perspective two different approaches can be deduced; a subjective and a theoretical assessment of the impacts. In the subjective approach each indicator score is given a subjectively defined weight allowing for adding indicator scores together yielding, in some cases, a single assessment score (see e.g. Schmidt et al. 2004). The more theoretically oriented approach is very similar but tries to establish weights based on research on how much each type of indicator score contributes to damage to the AoP and utilises these relationships to create a more condensed assessment result (see e.g. Weidema 2006). But even though the idea of introducing an impact assessment in SLCA is probably inspired by ELCA the concept seems to have slightly different functions, partly reflecting that the indicators in many SLCA approaches collect information about impacts or behaviour predisposing impacts rather than on the kind of fundamental behaviour which would parallel the physical flows which are inventoried in ELCA. Indicator scores in SLCA are thus more understandable in themselves (because they can be related to directly) making the ‘interpretation’ of the indicator scores less essential in SLCA, whereas indicator scores in ELCA have to be ‘translated’ into impacts or potential impacts to give meaning to most decision makers.

#### **1.2 The need for SLCA development**

As it can be deduced from the introduction above, SLCA is still at a relative early stage where different approaches are considered on all levels of the methodology, both in terms of boundary setting, AoP, impact categories and indicators and data collection method, as well as impact assessment (to mention the elements touched upon in this short overview). But despite their differences, several approaches were tested in case studies and were able to give life cycle oriented assessments of the social impacts of a product. It thus seems that there are already methodologies

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<sup>4</sup> According to the ISO 14044 (2006) processes are a set of interrelated or interacting activities that transforms inputs into outputs.

for performing what this study should contribute to develop, and it is therefore reasonable to ask whether there is in fact a need for further development.

To answer this question, some 'criteria of success' for the development of SLCA have to be established, enabling the assessment of the quality of SLCA methodologies.

In order to establish these criteria of success, it is important to point out that the development of SLCA deals with the development of a tool, and that tools are only interesting to the extent that they do what they are supposed to do. This project is in other words within what Ziman (1996, 1998) terms 'industrial science', directed towards solving a specific problem or task, as opposed to 'academic science', where the 'pursuit of truth' is seen as a goal in itself (Ziman *ibid.*). To establish these criteria of success there is thus a need for defining the specific task or problem SLCA is to solve or mitigate.

Somewhat surprisingly, very little explicit focus has been paid to the question of what SLCA is to solve or mitigate.

This thesis will therefore in the following define the overall purpose of developing SLCA which will lead to the formation of some criteria of success with which SLCA should comply in order for it to be 'satisfactorily developed'. However, it should be noted that different stakeholders may have different opinions about what purpose SLCA has. The proposed definition is therefore to a high degree reflecting the author's notions.

### **1.3 Identification of the goal of SLCA, the criteria of success for its development and purpose of study**

As mentioned above, very few explicit claims have been made about what problem SLCA is to solve or mitigate; however, one exception to this exists. In the recently published 'Guidelines for Social Life Cycle Assessment of Products' (Benoît & Mazijn 2009) it is stated that: "The ultimate objective for conducting an SLCA is to promote improvement of social conditions and of the overall socio-economic performance of a product throughout its life cycle for all of its stakeholders". In other words, the purpose of SLCA is defined as to improve social (including socio-economic) conditions for the stakeholders in the life cycle<sup>5</sup>. Accordingly, SLCA is to be more than just a 'fell good' tool; it should be a 'do good' tool, and ensuring a positive effect of SLCA on the assessed stakeholders is in this thesis taken to be the goal for the development of SLCA. This implies that the quality of an SLCA approach should be assessed from the perspective to what extent it is able to support the achievement of this goal.

As a point of departure in analysing the effect of SLCA it may be asked: How may this effect come about? To answer this question an idea of what it is that SLCA does is needed. As mentioned above, it is here assumed that the goal of SLCA is to provide decision support. This decision support may either create a change through decision makers following the 'advise' of the assessment, or in several other more indirect manners, for example through creating incentives in the market for companies to perform well on the issues included in the SLCA; through increasing the awareness among SLCA users and audience about the social impacts of various activities; or through its development and use to feed into the academic or public debates, etc. This thesis will address the 'direct effect' outlined above. The reason is primarily that this issue seem to lie within the 'SLCA methodology boundaries', as the question relates directly to the assessment that SLCA should provide, whereas the other questions seem to be related to fields of study much less related to the SLCA methodology in itself. Furthermore, intuitively it also seems that ensuring that SLCA has the

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<sup>5</sup> Stakeholders in the life cycle are here defined as the individuals affected by the product throughout its life cycle. Based on Jørgensen et al. (2008) this is considered to include the workers in the life cycle, the community in which the life cycle is taking place, and the product user.

necessary attributes for a positive effect to arise in a decision making context will not necessarily hamper any benefits from the other more indirect potential effects.

The effect addressed here is thus the potential positive effect of decision makers following the advice given by the applied SLCA methodology. In order for a positive effect to arise from following a decision, the alternative chosen on the basis of the assessment has to be associated with more favourable social impacts than the other assessed alternatives between which the decision is to be made. When speaking about SLCA creating a positive effect what is meant is thus the effect arising as a consequence of decision makers choosing an alternative having the most favourable social impacts, not that the assessment in itself creates any positive effect. Thus, in order for a decision to create a positive effect for the stakeholders in the life cycle of the assessed product, the SLCA should validly<sup>6</sup> illustrate the social consequences the alternatives have<sup>7,8</sup>. If this is not the case, the assessment will not enable the decision maker in choosing the alternative having the most favourable social impacts. Validity of the assessment is thus a criterion of success for the development of SLCA as it is a necessary precondition for SLCA to have a positive effect. However, the fact that the SLCA from a methodological point enables the user to perform valid assessments of the consequence of decision alternatives, will not create the kind of effect addressed here in itself; the SLCA furthermore has to be usable in a decision making context, which is then a second criterion of success for the development of SLCA. It therefore seems that to create this kind of effect, the SLCA should both enable valid assessments of the true consequences of a decision and at the same time be usable.

The purpose of this thesis is thus to add to the development of a SLCA, which both enables the assessment of the social consequences of a decision as validly as possible and which at the same time is as usable as possible in a decision making context. This will be done by addressing in a non-exhaustive way the two questions:

- *Which issues may hinder the usability and validity of the SLCA?... and*

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<sup>6</sup> An assessment will in this thesis be defined as 'valid' if the assessment measures what we intend to measure. An assessment methodology is valid if it allows for valid assessments. The degree to which an assessment is valid in other words defines the correspondence between reality and the assessment result. Validity is not to be confused with 'reliability' which 'merely' relates to reproducibility or the degree to which the result will always be the same if the assessment methodology is applied on the same situation. An assessment methodology can thereby be highly reliable without being valid whereas the opposite is not possible (Carmines & Zeller 1979).

<sup>7</sup> A question which arises is how we can validly assess social consequences. For this to make sense, we have to make a series of assumptions about the social world. First of all we have to assume that there is only one reality in the social world, i.e. that the consequences are real and that they can be examined and communicated accurately. If not, it does not make sense to say that an assessment of the social world resembles the reality of the social world. The social world is in other words in this SLCA framework assumed real, measurable, communicable and independent of our measurements. With the goal of developing an SLCA that assesses the real consequences, it may also be questioned whether it makes sense to develop an SLCA without these metaphysical assumptions, since if it is assumed that the assessment is in itself constructing a reality, there seems to be few arguments why the SLCA should be better than any other kind of thinkable assessment in terms of assessing reality and hence why it should have any particular weight in a decision making context.

The nature of the social world will not be discussed in any depth here but it should however be mentioned that opposite viewpoints are widespread throughout academia implying that several research paradigms within the social sciences would contest these assumptions. See for example Burrell & Morgan (1979) for a discussion of different research paradigms within the social sciences.

<sup>8</sup> This thesis will thus relate to the development of a 'consequential' SLCA rather than an 'attributional SLCA'. Consequential (S)LCA attempts to establish the consequences of a decision, and thus in principle includes an assessment of changes in all systems affected by a decision (Weidema 2003), typically that a process is included in the assessment if it is part of the product life cycle, disregarded whether a change occurs with regards to the process as a consequence of choosing the product.

- *What procedures should be incorporated in the SLCA alleviating these problems?*

This research approach can be criticised for being too technocratic. Technocratic in the sense that it assumes that the developer purely by shaping the technology<sup>9</sup> (the SLCA) can decide how it will interact with its surroundings; in this case create a positive effect on the stakeholders in the life cycle of the assessed product. It has for example been argued many times that in order to understand how technology gets adopted and used in society, it is not enough to understand technology in itself. In other words, it is (in most cases) not the developer or designer who decides the way in which the developed technology will be used, nor is it the user that fully decides for him- or herself how to use the technology. There will most often be a ‘disagreement’ and room for ‘negotiation’ between the user and technology where a mutual adaptation will be taking place. User and technology are so to speak located in an interplay where they together define how the technology will be used (Akrich 1992, Akrich et al. 2002a,b). The ‘top-down’ approach taken here where the purpose of SLCA has been identified on beforehand and used as a guide for its development, in comparison to a more ‘bottom-up’ inspired approach where a method is developed after which its merits are studied through case studies, could therefore be argued to put too much emphasis on the power of the developer.

But even though that the findings from a ‘top-down’ inspired study will not be able to guarantee that an SLCA lives up to a predefined purpose, the study may still come up with some necessary conditions for this to happen. In this relation it is also important to mention that this study will most likely be supplemented by more ‘bottom-up’ oriented approaches to the development of SLCA since this approach has until now been the most prevailing in the publications on SLCA.

Another issue which will be clearer later is that very different issues will influence to what extent SLCA meets its purpose. This study will thus analyse very different issues which could lead to the critique that the study is too broad and that the study preferably should focus more thoroughly on a narrower range of issues. Here it is important to remember that the development of SLCA is still at its infancy, as it was concluded in the review above, and at this point it seems more relevant to discuss the overall lines, than digging deep into an issue, which later in SLCA’s development may show to be less central.

In the following chapters the question of usability of SLCA will first be addressed, followed by three chapters addressing issues of validity of the SLCA.

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<sup>9</sup> The SLCA is here considered a technology but in a conceptual rather than physical form.

## 2 The usability of SLCA – taking a company perspective

This chapter is based on parts of Jørgensen et al. (2009a), which can be read in its entirety in appendix 3.

The purpose of this chapter is to address the usability of SLCA, which can be done in different ways. One method is to provide a potential user with an SLCA methodology and after application interview the user about the usability. Another way, which was chosen here, was to interview potential users about their potential use of SLCA. One problem here is that SLCA is not yet a well-defined methodology, as argued above, but based on its similarity to ELCA it is possible to outline several potential applications of SLCA and equally the tasks a user must be able to perform in order to make use of these applications. It is in other words possible to address the *attractiveness* of the different functionalities of SLCA and raise the question about the *feasibility* for the potential users in performing the necessary tasks for providing these functionalities. This analysis will not try to weigh these ‘costs and benefits’ of using SLCA against each other but merely attempt to outline what kind of functionality the SLCA should be able to provide and at the same time identify aspects which should be mitigated in the SLCA methodology to increase its usability.

Several different potential user groups may be identified. This chapter addresses the issues of attractiveness and feasibility of SLCA from a company perspective through a series of eight semi-structured interviews with larger Danish companies, all of which potentially have the capacity and will to use comprehensive social assessment methodologies.

### 2.1 Results

To address the attractiveness of the SLCA, it was necessary to address the companies’ positions towards the functionalities of SLCA, as mentioned above. From an overall perspective SLCA would, if developed as a parallel to ELCA, be able to fulfil the same overall functionalities. These are often considered as being; a comparative assertion where the two products providing similar functionalities are compared with regards to their social impacts; and a ‘hot-spot’ identification where the most significant social impacts in the life cycle identified. Within these overall lines some functionalities could be found, which the companies found attractive.

First of all, some of the companies found the comparable assertion attractive, as sketched above. Apart from this, some companies also mentioned the assessment of the social impacts related to the use stage<sup>10</sup> of a product as an attractive functionality, which potentially could be supported by an SLCA including also (or in this case only) the assessment of the use stage. Finally, one company had experienced a dilemma where they had to choose between imposing different (negative) social impacts on their stakeholders and searched for guidelines that could legitimate their actions in these situations. Weighting different environmental impacts against each other is a part of ELCA and again taking SLCA to parallel ELCA, this may potentially be supported by an SLCA.

The interviews also showed that the companies did not find the identification of the most significant social impacts in the product chain an attractive functionality of the SLCA. Almost all companies already had their own satisfactory screening tools for identifying potential ‘hot-spots, for example through various relatively simple risk assessment tools and social auditing procedures.

Taken together there was therefore an impression that SLCA was to some extent found attractive for external purposes, i.e. purposes where the company demonstrated or, in the case of the weighting, justified the social impacts of their product’s life cycle to the outside world, whereas for internal and management oriented uses SLCA was found unattractive by the interviewed companies.

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<sup>10</sup> The life cycle of a product is normally divided in the stage where raw materials are extracted; the production stage; the use stage where the product is used; and the disposal stage. In between these stages various transport stages may occur.

But as noticed above to what extent SLCA is usable is not only a question about what is attractive, it is also a question of what is feasible for the company to do. As it has already been suggested in previous literature (Schmidt et al. 2004, Manhart & Griebhammer 2006) data availability may be a demanding issue in relation to performing an SLCA. As noted in section 1.1.3 it is important to remember that it is generally assumed in the SLCA community that social impacts in the life cycle of a product or service are related to the management of the production processes or the use of the product and less to the nature of the processes or products themselves (Dreyer et al. 2006; Spillemaeckers et al. 2004)<sup>11</sup>. In order to know how something is produced, it must at least be known where it is produced and preferably also under which conditions, information which cannot be determined from knowledge of the product and a bill of materials and list of production processes. The availability of this information and, hence, the interviewee's possibilities for getting knowledge about their product chains is central. It was therefore investigated during the interviews to what extent the companies were able to get information about their life cycle. What became apparent during these interviews was that companies were able to get information about their first up- or downstream tier, but further than that most companies were unable or unwilling to go. This could be either because of the unwillingness of suppliers to hand over this information to the companies; because the goods were bought on open markets furnished by a large number of unidentified suppliers; or some companies even considered it 'bad business practice' since it indicated a lack of trust in their supplier to check its own suppliers.

Considering these results together it seems that even though the comparative assertion was the functionality of SLCA found most attractive by the companies, it may face significant problems, considering the difficulties of getting knowledge about the remote up- and downstream tiers. This problem was emphasised by the need for site specific data in SLCA, making the data collection very time and resource consuming. Even if it is assumed that proxy data can be established on the social impacts of the life cycle in its various steps, for example through knowledge about the country in which the up- or downstream tier is located, even this information could be more than the company was able to obtain, making the comparative assertion problematic.

The use stage assessment and the weighting functionality of SLCA on the other hand would not face the same problems, as the data requirements in both cases are much more limited.

It thus seems that the interviewed companies' use of SLCA will be restricted to applications with very limited or no life cycle perspective.

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<sup>11</sup> It has been claimed that social impacts relate entirely to the conduct of the company in contrast to environmental impacts relating to the nature of the process. This to some extent makes sense since it seems that there are no cases where certain social impacts will necessarily arise from certain processes, whereas when it comes to some environmental impacts the conduct of the company may influence efficiencies but still to produce e.g. a ton of iron, inevitably requires one ton of iron. The necessity to which social impacts and some environmental impacts occur as a consequence of a process therefore seems different. However, looking at it from a statistical perspective it seems reasonable to expect that certain processes will tend to be correlated with certain impacts. Consider for example different types of work related injuries, which is an often included impact category in SLCA (see section 1.1.2). In this case, it seems reasonable to expect e.g. a higher number of cuts and bruises for a mechanic than for an office worker. The job function of a mechanic or an office worker will in other words presumably tend to be correlated to these types of impacts in certain ways. In other cases, the correlation between social impact and process may be less strong, for example in relation to 'discrimination towards employees', which is another often included impact category in SLCA (see section 1.1.2).

No empirical studies addressing these issues have yet been made, however if these hypotheses can be accepted and if statistical correlations are sufficient it implies that using process related data in SLCA will probably give a highly uncertain but not entirely random assessment for many types of social impacts.



## 2.2 Implications for the development of SLCA

A problem with the focus on the intention of using SLCA in this study is that it may be a very unstable phenomenon to address, since company intentions may change overnight. It may therefore be argued that the main outcome of the study is the point that it cannot be expected that SLCA will necessarily be highly used in companies, especially because of the rather clear indications that the issue of access to data should be seen as a central aspect for the usability of SLCA.

How to develop SLCA so that it more easily utilises accessible data is not an easy task, since it seems that knowledge about far up- and downstream tiers are needed, which companies in many cases are not able to get information about, not even issues like the location of their suppliers. Thus, at least with their present motivation, maybe the only way to increase data availability would be to utilise probably highly uncertain generic process related data with the price of a large decrease in the validity of the assessment (see footnote 11). In line with this and seen with the benefit of hindsight, it would have been beneficial to have addressed more thoroughly how accurate the assessment had to be (even though this obviously is a rather complex question to address). A potential problem with using very inaccurate data for a company for external purposes would be the risk to take credit for the results given by a potential untrue assessment, which, if being the case and later discovered, may be highly incriminating for the company; the assessment may in other words 'backfire'. Rather the company would probably prefer not to embellish themselves on the basis of an assessment building on large uncertainties, as would most likely be the case here. These issues may, however, be for future studies to address.

But if this hypothesis is accepted, it seems that the possibilities for using SLCA may be different for other user groups, for example governments and intergovernmental organisations or non-governmental organisations (NGOs). Considering for example the use of SLCA in governmental and intergovernmental organisations, it may be expected that the focus will be on obtaining decision support, for example in relation to which system to implement in a society. In such a case, the issue of 'backfiring' is probably smaller, as it may be expected that the governments and intergovernmental organisations will not make use of the SLCA to embellish a certain system but rather to get as accurate decision support as possible. And in this regard, in some cases, even uncertain data may be the best obtainable and thus better than no data at all, which will not necessarily be the case for the companies, as argued above. The limitations in companies to obtain the needed data for the comparative assertions and the potential lower levels for what is acceptable for governments and intergovernmental organisations, thus points to the possibility that SLCA will develop to become more prominent in a regulatory decision context rather than in a company context.

Another point which could also have been interesting to address in the interviews regards the product perspective of the SLCA. As it was discussed in footnote 11, it seems reasonable to assume that even though social impacts may in some cases be statistically correlated to the process, social impacts and process will not have a strong causal connection as it is to some extent the case with environmental impacts. This may to some extent make product oriented social assessments less 'relevant' than it does to perform product oriented environmental assessments: An ELCA intuitively makes sense if it is assumed that there are causal connections between the process and impacts, meaning that the product 'directly causes' its environmental impacts. In SLCA the situation is different because the processes included in a product's life cycle can to a large extent be seen as 'bystanders' to the impacts arising in the production, i.e. the processes does not in themselves cause these social impacts. Obviously the impacts are 'indirectly caused' by the processes since if the production did not need to take place, then the workers would not need to work at the company meaning that they would not be exposed to the social impacts from this work. To what extent this

degree of 'directness' of cause is important for the attractiveness of SLCA was not addressed here and may be for future studies to address, however, during the interviews this postulate was to some extent supported or at least not falsified by the specific interest from two medical companies in the use stage assessment with the purpose to demonstrate the (probably) beneficial effects of their products in this stage, which is to a large extent an effect created by the nature of the product implying a more direct causality between product and impact.

### **3 The validity of SLCA**

As already concluded in the study above, given the limited ‘types’ of potential users included in the study and their potential changing motivations, the study only gives a very limited insight in how SLCA should be developed to increase the usability of SLCA. Many other studies could be imagined as noted above, which could shed light on other potential user groups’ preferences, such as governments’, intergovernmental organisations’ and NGOs’.

In the following this issue will, however, be laid aside and instead the issue of validity of SLCA will be addressed. The reason for this change is that the more ‘common’ approach to SLCA research is directed towards application, as pointed out in section 1.2 above. As this is the case, the issue of usability will to some extent inevitably be addressed in these studies. In comparison to these studies, the study above can merely be seen as a kind of ‘shortcut’ to some insight in the preferences of the potential users without having to develop and apply an SLCA methodology. But with regards to the issue of validity of SLCA, the research approach directed towards application will offer very little: Validity can in general be checked in two ways: Either the assessment result can be checked against an already validated standard, or the validity of the assumptions on the basis of which the assessment is made can be checked. In this case no validated standard exists with which case study results can be compared. This implies that the only way to ensure validity of the assessment results is to ensure that the assumptions and theories on which the assessment are valid; an issue which will not necessarily be addressed in research approaches directed towards application. The goal for these studies addressing the validity of SLCA in this section and in section 3.2 and 3.3, is thus to check the theories and assumptions underlying or embedded in the SLCA methodology and where relevant suggest methodological improvements.

To perform such an assessment of the validity of the assumptions and theories on which the SLCA is based, an overview of how such theories and assumptions are included in the assessment is needed.

From the defined goal of SLCA above it was found that the SLCA should validly assess the consequences of a product’s life cycle in relation to the defined AoP. To assess these consequences, impacts on individuals and societies affected by the life cycle of the product must be assessed. To get a completely valid assessment, a complete overview of which individuals and societies are affected in what way by the product life cycle is thus needed. To know in what way individuals and societies are impacted, we need; a complete overview of how these individuals and societies may be impacted; an assessment of the occurrence of these impacts; and finally, to the extent relevant an assessment of how these impacts affect the defined AoP.

On this basis we can thus conceptualise the issue of obtaining a valid assessment of impacts on the AoP as a question of:

1. Identifying the individuals and societies impacted as a consequence of the product’s life cycle
2. Identifying the complete range of impacts on these individuals and societies
3. Assessing the complete range of impacts on these individuals and societies
4. Assessing how these impacts affects the AoP

Item 1 and 2 relate to the boundary setting and through the definition of the AoP to the identification of the impact categories to include in the assessment. This relates to the scope definition as was introduced in section 1.1. Item 3 relates to the inventory analysis, whereas item 4 relates to the impact assessment. Each of these items will involve reviewing several theories and assumptions, of which some will be analysed in the following. Section 3.1 will primarily address

the issue of the assumed causality between indicators and AoP, thereby mainly related to item 4, but will also address critically the issue of how the AoP is defined in SLCA. Section 3.2 will primarily address the issue of setting the boundary for the systems and types of impacts to assess in SLCA and thereby relate primarily to item 1 and 2. Finally, Section 3.3 will address the context dependency of SLCA which in this case primarily relates to item 3 and 4.

### **3.1 The validity of impact pathways in SLCA**

This chapter is based on Jørgensen et al. (2009b), which can be found in its entirety in appendix 4. As has already been mentioned in section 1.1.2 many, if not all, SLCA approaches are based on an idea of an overall concept on which they want to assess impacts either by explicitly stating an AoP or for example by stating that the assessment measures degrees of social sustainability. The idea behind SLCA is in other words most often that if the assessment shows a better result, the assessed product or system is better in relation to the AoP or e.g. more socially sustainable than a product or system which gets a lower score.

By adopting an AoP (implicitly or explicitly) most SLCA approaches more or less explicitly assume a range of causal relationships or impact pathways, as they are called in the ELCA literature, connecting the indicators we use in the assessment, and the AoP (see figure 1 below for illustration).

A central issue in relation to assessing as accurately as possible the damage on or benefits to the AoP, is that there has to be a valid impact pathway between the indicators that are used to assess the damage or benefits from the life cycle and the AoP. If there is no valid impact pathway there is no way of telling whether and to what extent the indicators that we apply in SLCA actually represent damage on or benefits to the AoP. A valid impact pathway in other words ensures that a certain indicator score has a certain, predictable impact on the AoP. This concern has not gained much attention in SLCA literature and this may imply that there is no theoretically well-founded relationship between the indicators included in many SLCA studies and the AoPs (whether the latter are explicitly defined in the studies or not). In this chapter two different examples of validity problems in the impact pathways in existing SLCA approaches are presented. The two examples take opposite perspectives when addressing the issue: The first example starts in the AoP end of the impact pathway and analyses whether the types of indicators that are used in the various SLCA approaches are actually able to validly assess damages or benefits to the AoP. The second example starts in the opposite 'end' of the impact pathway by examining a specific indicator, which is often applied in SLCA approaches, and analysing whether this indicator actually assesses damage on or benefit to the AoPs as defined in SLCA. The assessment of the validity of these (often implicit) impact pathways in SLCA is substantiated drawing on empirical findings from relevant fields of research.

#### **3.1.1 Example 1: The well-being of the stakeholder**

In the SLCA literature the AoP has been defined as either the intrinsic value of the well-being of humans (in a broad notion) (Dreyer et al. 2006; Weidema 2006; Benoît & Mazijn 2009; Nazarkina & Le Bocq 2006) or the preservation or enhancement of different types of 'societal capitals' (Schmidt et al. 2004; Nazarkina & Le Bocq 2006)

In the approaches dealing with the AoP focusing on well-being, the meaning of well-being is not addressed in great detail. However, going through the definitions given by Dreyer et al. (2006), Weidema (2006) and Benoît & Mazijn (2009), it may be argued that since they in their approaches consider issues like 'dignity', 'anxiety' 'happiness' and 'satisfaction', all approaches seem to understand well-being as something which at least partly is defined by the experience of the individual. Nazarkina and Le Bocq (2006) on the other hand explicitly dismiss the understanding of well-being as defined by the experience of the individual and focuses only on well-being understood as something discernible from the world external to the individual, e.g. living conditions.

The assessment of the individual's experience of well-being has a long tradition in several fields of research (e.g. Shalock 1996; Cummins 2005; WHO 1995; Sirgy et al. 2006). Here, this type of well-being is often denoted subjective well-being (SWB).

Within these fields of research in the assessment of SWB a distinction is made between objective and subjective indicators (see for example Sirgy et al. 2006). Objective indicators are indicators that are designed to measure impacts which can, at least potentially, be measured without the involvement of the experiences of the impacted stakeholder, for example, wages and working hours etc. Subjective indicators, on the other hand, are indicators that focus on the experiences or feelings of the impacted stakeholder.

Going through the actual indicators presented in the various SLCA approaches, it is found that only objective indicators are included. Assuming now that we are in fact interested in assessing well-being as outlined above, there has to be a valid impact pathway connecting SWB, which is (part of) our AoP, with objective indicators.

This aspect has been addressed empirically several times in the above mentioned fields of research mentioned. Here it shows that poor correlations are repeatedly found between various objective indicators and SWB (Cummins 2000, Diener & Biswas-Diener 2002). The idea of creating a simple impact pathway between objective indicators and SWB of the stakeholder therefore lacks validity in most situations. Objective indicators can therefore only to a limited extent be applied in the assessment of SWB whereas subjective indicators are central in obtaining a more valid assessment. Thus, if well-being as defined in the AoP should (at least partly) be understood as SWB, it seems that including subjective indicators in the assessment would improve the validity.

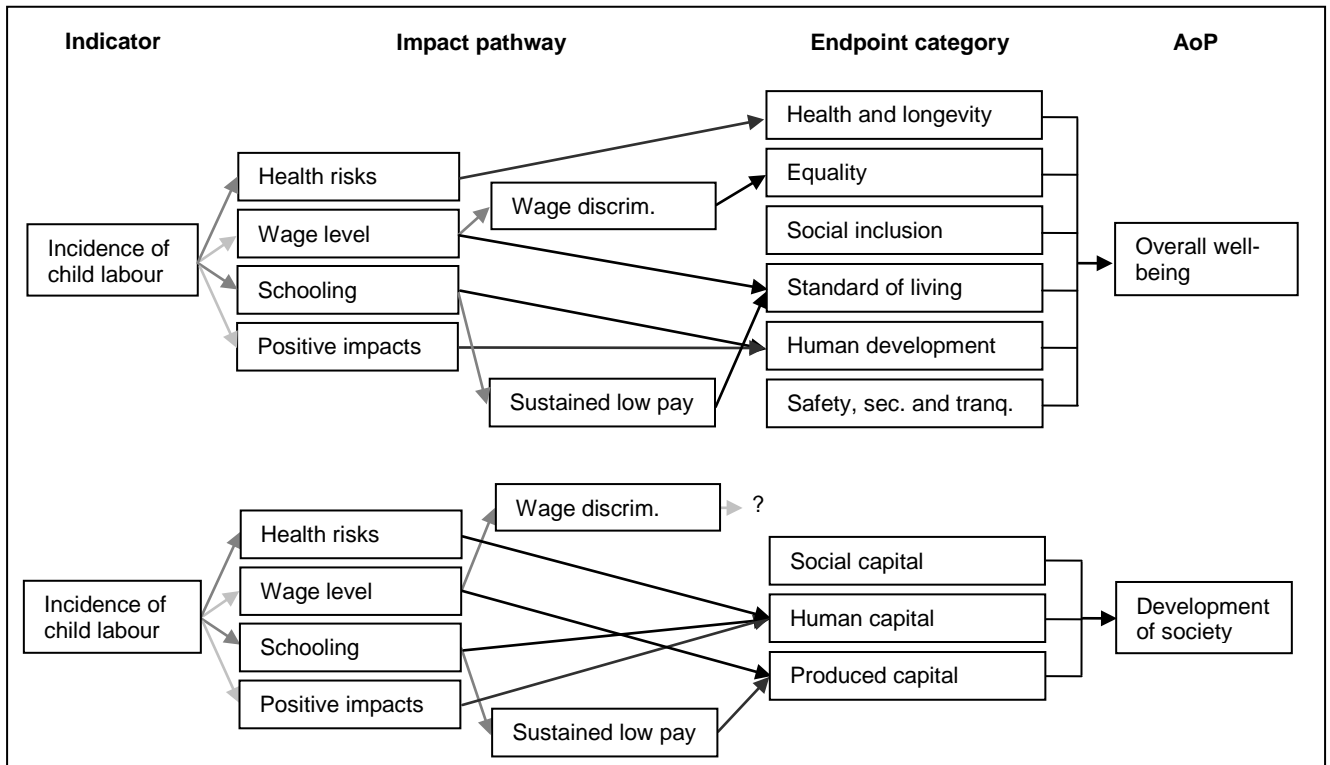
### **3.1.2 Example 2: Indicators on child labour**

Child labour is an often included impact category in SLCA approaches, as can be seen in table 1, section 1.1.2. Through an analysis of the approaches including the child labour impact category, it becomes clear that the most common indicator, i.e. the way to measure this type of impact, is defined as ‘the incidence of child labour’ (Barthel et al. 2005; Dreyer et al. 2006; Manhart & Griebhammer 2006; Nazarkina & Le Bocq 2006). This section analyses to what extent this indicator gives a predictable impact on the AoP, i.e. to what extent there is a fixed correlation between the incidence of child labour and impacts on the AoP.

As we saw in the sections above, two AoPs can be identified namely the ones focusing on the well-being of the individual (Dreyer et al 2006; Weidema 2006; Nazarkina & Le Bocq 2006) and one focusing on the societal wealth (Schmidt et al. 2004, Nazarkina & Le Bocq 2006). As both AoPs are relatively loosely defined (as also shown in the example above) these AoPs have been concretised into a list of issues, often known as endpoint categories. With a little variation between the various scholars, these have been defined as health and longevity; equality; social inclusion; standard of living; human development; and safety, security and tranquillity.

For the definitions of the AoP focusing on the societal wealth the endpoint categories have been set to ‘social capital’ i.e. resources in social networks; human capital, i.e. resources in the individual; and finally produced/physical capital, denoting resources in infrastructure.

On the basis of empirical investigations of the consequences of child labour, the analysis shows that even though ‘the incidence of child labour’ is a relevant measure for impacts on both defined AoPs, its validity may be increased by assessing the impacts of child labour, among others being health impacts and impacts on schooling outcomes, since these impacts varies according to the type of child labour. The relation between indicator, impact pathway, endpoint categories and AoP are showed in figure 1 below.



**Figure 1:** The child labour impact pathway. The figure sums up the analyses of the correlation between indicator and impact on the AoP and shows how a certain ‘amount’ of a given phenomenon, e.g. ‘incidence of child labour’ or ‘schooling outcomes’ affects next step in the impact pathway. A black arrow represents a relatively well-documented, predictable relationship; a dark grey arrow represents a relatively well documented but unpredictable relationship; and a light grey arrow a potential, yet relatively undocumented and therefore potentially unpredictable relationship. For a more comprehensive discussion of the figure, see appendix 4.

By only assessing ‘the incidence of child labour’ we may thus not capture the fact that the ‘seriousness’ of child labour varies with the type of labour the child performs. An assessment only considering the incidence of child labour will thus be less valid than an assessment among others assessing ‘impacts of child labour on health’ and ‘impacts of child labour on schooling outcomes’.

### 3.1.3 Implications for the development of SLCA

Even though the inclusion of the more detailed indicators on child labour and subjective indicators may improve the validity of the assessment, several problems related to their inclusion may be identified. Probably most noticeable is that both inclusions may highly increase the data needs; in relation to the subjective indicators because of the need to assess the experience of the actually impacted individual, and in relation to the child labour case, because of the more detailed information needed about the character of the child labour. From a usability perspective data collection is likely to be a considerable task in performing SLCA (see section 2.1) and the inclusion of subjective indicators and more detailed child labour indicators is likely to intensify this problem. As a final remark on the analysis above, it demonstrates the possibility of analysing and assessing the validity of the impact pathways applied in SLCA, as it is done in ELCA, and comes up with concrete examples of indicators. It may (still) be difficult to make a quantification of the indicator results in terms of impacts on the AoP as is to some extent possible in ELCA, but the qualitative analyses performed here take us the first step in identifying the (type of) indicators which can

measure what we intent to measure in a more valid way.



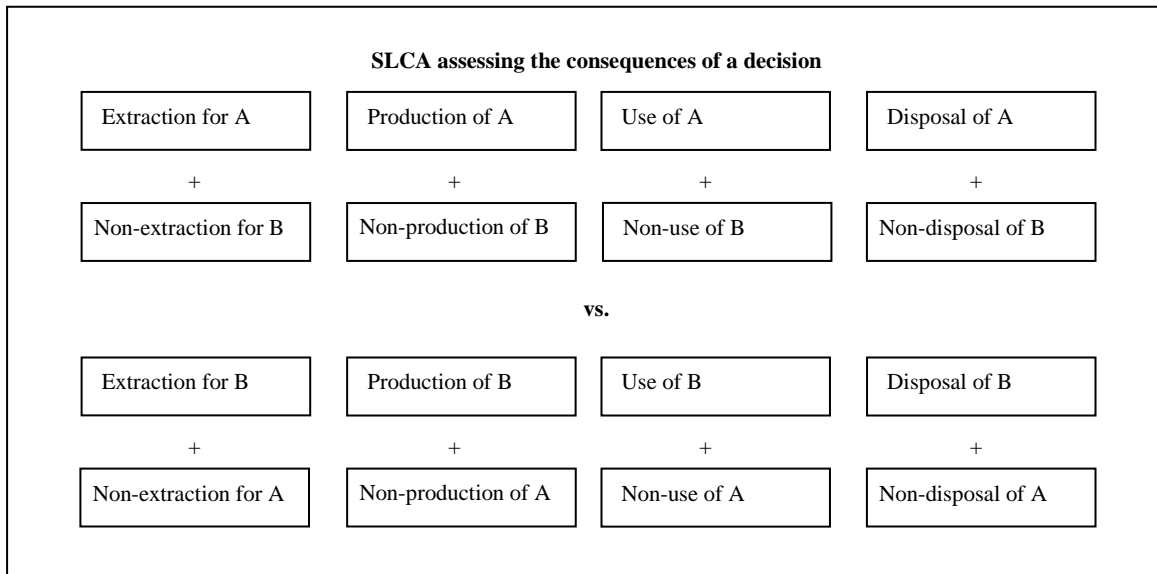
### 3.2 Addressing the baseline in SLCA

This chapter is based on Jørgensen et al. (2010), which can be found in its entirety in appendix 5. As outlined in section 1.3, a necessary prerequisite for SLCA to have a beneficial effect on the stakeholders in the life cycle of the assessed product or service, is that the SLCA validly assesses the consequences of a decision. However, the consequence of a decision does not simply reflect the actual actions. More precisely, it can be expressed as the difference between how the world is or will be on the basis of the decision the SLCA is to support and how the world would look like had it not been for this decision. The purpose of this chapter is to qualify the assessment of this difference by looking more detailed into what happens when a decision is not implemented.

To assess the consequences of a decision in a valid way, we can to a large extent draw on the existing work on ‘consequential ELCA’ which is equally addressing the issue of assessing the (environmental) consequences of a decision. The key issue in consequential ELCA is ‘...*the identification of the unit processes that change as a consequence of a decision*’ (Weidema & Ekvall 2009). This is central because the idea in ELCA is that it is where the processes are being carried out, impacts occur, and if no processes are being carried out, no impacts occur. However, in SLCA this is only partly the case: In SLCA what we are interested in are social impacts on the stakeholders in the life cycle. If considering stakeholders being persons, which in SLCA may be either the worker or the product user (Jørgensen et al. 2008), SLCA is in other words concerned with certain changes in the lives of the worker or the user. But changes in lives do not only occur when a process is carried out or a product is used; they occur in all of life’s situations – also when not carrying out a process or using a product. Considering also that the worker or user is ‘occupied’ by carrying out the process or the use of a product, the worker or the user will have to do something else when the process is not performed or the product not used. This implies that when we are to find the changes that a process or a product use creates in the lives of the worker or user, we should not only look at the impacts created by the process or product use, we should also look at the impacts avoided in the lives that would have been lived, had it not been for the changes in processes or product use. In other words, the changes to be considered in the life of the worker or user is therefore the impacts associated with the carrying of the process or using the product vs. the impacts of doing something else when not being engaged with the carrying out of the process or using the product.

When it comes to stakeholders being an organisation or institution, in SLCA most commonly the surrounding society (Jørgensen et al. 2008), it seems that the situation is somewhat different: For the surrounding society it seems that the processes will not interrupt its ‘life’ in the same way as it may for the individual stakeholder. The surrounding society is able to lead its ‘life’ with and without the carrying out of the process, where the impacts of the process are simply ‘added’ to its ‘life’, making the difference to be assessed in SLCA as presented here the impacts associated with the carrying out of the process vs. nothing, just like it is normally done for impacts on the environment in ELCA.

Collectively this implies that an assessment of the consequences of a decision should include the assessment of the non-production (referring to both non-extraction, -production, -disposal, and -transport) in relation to the worker and the non-use in relation to the user. An overview of the changed structure of SLCA is given below:



**Figure 2:** The structure of a SLCA for assessing the consequences of a decision between product A and B. If the decision of whether to choose A does not imply the choice of any other product, B, all stages related to B will be 0. In ELCA all ‘non’ stages would normally be assumed to be zero.

The impacts of which can be identified on a generic basis of non-production in relation to the worker arise as a consequence of increased unemployment. However, due to competitive mechanisms among employed and unemployed, there will be some kind of hierarchy among the employed and unemployed based on their qualifications, which will imply that it is not necessarily the worker who initially gets fired who will be the one who will experience the unemployment on the longer term. Rather the increased level of unemployment in the society will be ‘passed on’, affecting the margin in this ‘qualification hierarchy’. It may thus be difficult to locate the exact individual affected on the long term by the increase unemployment in the non-production situation. According to literature, the personal impacts associated with unemployment are related to decreases in physical and mental health (Waddell & Burton, 2006; McLean et al., 2005); increased levels of poverty (Hakim 1982), increased tensions, conflicts, and health in the unemployed individual’s family (Ström 2003; Hakim 1982); and potentially also levels of crime (Chiricos 1987; Freeman, 1999; Hakim 1982).

However, when engaging in the assessment of these impacts associated with unemployment, it quickly becomes evident that different unemployment situations create different ‘amounts’ of these impacts. Literature on unemployment proposes many ‘modifying factors’ which influence how ‘effective’ unemployment or decreased production is in creating the mentioned impacts.

But considering that we are not able to identify the actual person affected by unemployment due to the ‘qualification hierarchy’ described above, and that how unemployment affects the individual is in most cases highly personal, creates a situation where it will be very difficult to assess the actual impacts on the worker in the non-production situation. However, some of the ‘modifying factors’ are not defined by the personal context but rather by the societal context and since it probably often is possible to identify the society affected by increased unemployment in the non-production situation, some rough assessment of the impacts of unemployment in the non-production situation may be possible. It is for example shown that the level of social security for the unemployed in the society is a modifying factor which will be negatively correlated with the negative impacts of unemployment; meaning on an overall level that the more social security, the less of the negative impacts on the unemployed. Thus, simply by knowing the level of social security available for the

unemployed in a society we may get some indications on its significance, however uncertain this assessment it may be.

It may be that this discussion about the impacts of not producing may seem as a somewhat theoretical exercise. But this is far from the case. Consider following real example: In 2006 Nike discovered that one of their suppliers, Saga Sports in Pakistan, employed child labour. In fear of moral condemnation from their customers, Nike chose to sever their contract with the company. But since 70 percent of Saga Sports' production went to Nike, many of the 4000 workers were dismissed, impacting not only the workers but also the local society, where an estimated 20,000 people depended on the income (CSR monitor 2006). Assume now that a SLCA was made of the consequences of producing a football at Saga Sports not including the impacts of not producing. The assessment would capture the impacts of child labour in the production, and show that if we produced the balls somewhere else where no children were employed, the child labour would (probably) be eliminated in the production, and all other being equal, this would create a 'socially better' product.

But that is obviously not the complete consequences of the situation outlined above where a large amount of people were being laid off because of the decision creating all kinds of negative social impacts in the local community. Including the impacts of not producing would give a more valid picture of these consequences.

When discussing the difference between the use and the non-use situation for the users in the life cycle, an important characteristic of products is that the use of products occupies resources, meaning that the use of products tend to inhibit the use of other products or activities in general. Examples of resources may be e.g. time, attention and money, but other resources could be imagined as well. That products 'occupy' money has for example been considered in consequential ELCA literature by Thiesen et al. (2008). Here it is argued that we have a specific, limited amount of money available and that it will always be used. Thus, if not used to obtain the product we are assessing, we call this A; we use our money for something else, B. The non-use situation is, according to this perspective the impacts related to the provision of B which is acquired for the resources made available by not buying A. In this way, an assessment of the consequences of the life cycle of A will very often become a comparison to what would have been acquired, if not A. However, this identification of consumer behaviour, if not buying product A can be seen as part of the procedure in consequential ELCA to identify which processes will be affected by a decision; in this case the processes relating to the life cycle of either product A or B. Thus, if this was the only impact on the user, that s/he would use something else, this would fully be accounted for by following the consequential ELCA methodology (assuming that it is perfect), implying that all impacts related to the non-use would be covered. However, this is not entirely true. If we consider that the use of a product for the user occupies not only money but also time and attention, the user will by not using the product have to spend his or her time and attention on something else, which can be something else than using other products. The non-use may in this way be associated with impacts which will not be related to other product life cycles and thereby not be caught in an SLCA only considering impacts of production and use.

However, the identification of the actual impacts of the non-use and to establish indicators for their measurement is not something we can identify on a generic level, since this is fully dependent on the type of product. This question therefore has to be dealt with on a case to case basis.

### **3.2.1 Implications for the development of SLCA**

Again it seems, like in section 3.1.3, that the increased validity of the assessment by introducing the assessment of the non-implemented life cycle will highly increase the work load of conducting an

SLCA. It may be that an assessment of the impacts on the worker can be performed through relatively simple assessments, as argued above, which will obviously not create any accurate assessment, but in this case, a crude assessment pointing in the right direction will still give a much more valid assessment than assuming the impacts of non-production to be non-existing. What may be very demanding, on the other hand, is the assessment of the impacts related to the non-use, which may vary depending on both the product user and how much time and attention the user will be spending on it. However, due this complexity the analysis was not able to show how important the impacts associated to the non-use are and on this basis how important these impacts are to include in the assessment. If they show to be important it therefore seems highly relevant to identify a practical approach for its inclusion. How such analysis can be performed was not discussed in this article.

### **3.3 The influence of the context on the validity of SLCA**

The influence of the context on the validity of SLCA was only addressed briefly in this project and the discussions on the issue did not reach a mature state and was therefore never written in an article form. Still, some of the discussions are seen as valuable contributions and are therefore included below.

The life cycles which will be assessed in the SLCA may often be global in scope, meaning that also the SLCA will have a global scope. SLCA will therefore potentially be applied in all kinds of different contexts<sup>12</sup>.

From our everyday life we generally acknowledge that there is some degree of variation in how people and societies respond to situations. Should this be the case, it seems very possible that the assessment to be performed in an SLCA would be influenced by the contextual background in which the assessment is made. An example of this has already been given in relation to the impacts of unemployment in section 3.2 above where it was shown that the severity of unemployment may depend on a series of contextual issues. As in the case of unemployment, the problem that may arise from this contextual variation in how people or societies react to different situations is that the assessments will become more valid in some contexts than in other, implying that the validity of the SLCA will be varying according to context (at least if not accounted for in the methodology).

The issue of how to deal with contextual variation in SLCA has only been addressed in a few cases. Exceptions are Norris' (2006) SLCA approach which takes its point of departure in the decreasing gain in life time expectancy per increase in PPP, implying that contexts with low PPPs will have higher life time expectancy gains per increase in PPP than rich countries. Hunkeler (2006) develop context dependent characterisation factors. In this way, both scholars assumingly modify their indicator scores in order to give more valid assessment results. Also Dreyer et al. (2006, 2009) considers the context by opening up for context specific impact categories and impact assessments in order to cope with the specific conditions of the assessed company. But besides these cases little attention has been paid to the potential influence of the contextual variations on the validity of the assessment results. In the following discussion we will present two examples of how the context may influence the validity of SLCA. The first example relates to the significance of the defined endpoint categories for one of the two defined AoPs in SLCA. The second example addresses the context dependency of data collection procedures potentially used in SLCA. Other context related issues such as how and for what SLCA will be used and how it is interpreted will not be addressed here.

#### **3.3.1 Well-being and context**

In this example we will address the AoP focusing on the well-being of the individual (see section 3.1.2). For this AoP a list of endpoint categories on the basis of Dreyer et al. (2006), Weidema (2006) and Nazarkina & Le Bocq (2006) was proposed comprising; health and longevity; equality; social inclusion; standard of living; human development; and safety, security and tranquillity (see also section XX). In all approaches these endpoints are taken to be universal.

As noted in section 3.1.1 SLCA other fields of research are also working with the assessment of (impacts on) well-being, including also the discussions about the contextual variation of well-being (e.g. Shalock 1996; Cummins 2005; WHO 1995; Sirgy et al. 2006).

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<sup>12</sup> A detailed discussion on how we define or delimit context will not be given here. Context will here simply be understood as 'background variables' which the assessed product life cycle has no or at least only very weak influence on and which may cause humans or societies to respond differently from place to place due to many here unspecified factors.

Comparing the AoP definition and the definitions given in these parallel fields of research, there are some discrepancies, primarily in the sense that the AoP definition given above is less comprehensive. This of course opens up for a discussion whether the AoP definition on well-being is too narrow, since it seems that it is in general the same construct that is intended to be measured, however, this discussion will not be taken here. What is more central in this regard is that since it is more comprehensive, studies on the contextual variation of the well-being construct in these traditions will also comprise the contextual variation of the AoP and may thus be a suitable point of departure for the discussion of the contextual variation of the AoP focusing on the individual well-being.

One study on the contextual variation of well-being is presented by Schalock et al. (2005), who make an empirical investigation across five geographical groups including Spain, central/South America, Canada, Mainland China and the United States. They find support for the hypotheses that well-being has both universal and contextually bound properties: First of all, their findings indicate that the proposed endpoint categories<sup>13</sup> comprising well-being are universal, yet, the study also finds support for the hypothesis that the well-being construct is contextually bound, since the importance of the various endpoint category varies depending on context. More specifically, the analysis shows that all endpoint categories in general are valued lower by some geographical groups, but more interesting for this analysis, the study shows significant differences across respondents and geographical groups when valuing the importance of the various endpoint categories. A similar conclusion is reached by Jenaro et al. (2005) who conduct a parallel study across France, Belgium, Italy and Poland.<sup>14</sup>

This example thus shows that simply assuming that human well-being will always be impacted in the same way by a certain phenomenon across different contexts is too simplistic and that by making this assumption the validity of the assessment will be lowered. However, with regards to the magnitude of this variation it should be mentioned that all endpoint categories were regarded as important in all contexts, and the studies only implied a slight, yet significant difference in the weighting of the individual endpoint categories. Still, to minimise this uncertainty it should be noted that since endpoint categories seem to be universally valid, the problem could be solved by applying standardised weights according to context.

### 3.3.2 The data collection

In the above example it was shown how the endpoint categories of human well-being may vary in significance depending on context. In this small analysis it will be suggested that also the issue of how to obtain valid data about the issues affecting the endpoints may depend on context.

As indicated in section 2.1 several scholars within SLCA suggest the need for site specific data collection. Site specific data on social impacts can be collected through audits, often called 'social audits', which may be described as an attempt to identify, measure, evaluate, report and monitor the effects a corporation is having on a society that are not covered in the traditional financial reports (Natale & Ford 1994).

How a social audit is performed is very important for the accuracy of the audit (Pruett 2005). For example, simply assuming that management in a company is telling the truth about the workers right to organise or even that the workers do when interviewed in the work place may in many cases be misleading. Thus, claiming that when data is gathered through audits, accurate data is obtained

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<sup>13</sup> Schalock et al. (2005) do not use the term endpoint categories, but rather 'core domains'. However, here we will keep to the LCA terminology and use the endpoint category term.

<sup>14</sup> It should be noted that these studies are made in the field of disability research, implying that they address contextual variation of endpoint categories in relation to disabled persons. Cummins (2005) supports, however, that these conclusions are broadly valid.

may be too optimistic (Pruett 2005, ETI Forum 2006, O'Rourke 2000). The procedure how this is done is therefore crucial. In relation to this example, what is important to identify is whether auditors perform audits differently depending on the context in order for the audit to represent the actual situation as accurately as possible, i.e. to get a valid assessment. However, as no such studies exist in the present literature on social auditing, the author of this thesis made a very limited empirical investigation on the issue, which was planned to be a first investigation in a series which should address the question. The project did, however, never get that far.

The chosen method was to perform relatively structured interviews with social auditors. The more structured approach was chosen because we had a rather clear idea about the purpose of the interview. However, an obstacle was that auditors obviously do not perform audits to do an SLCA. Another form of audit which is performed, on the other hand, is to check whether suppliers operate according to a company's Code of Conduct (CoC). In some ways the SLCA indicators and a CoC can be compared, as they both state aspects which should be followed in the operation of e.g. the audited supplier. Yet, whereas the goal of a CoC is to check compliance, the SLCA is often considered to be more ambitious; not only should it check whether or not certain types of impact are occurring, it should also check the magnitude to which these are occurring in order to get a more nuanced score than just a yes or no to compliance. This would obviously create a small change in the auditing procedure, but it was still found safe to 'extrapolate' the experiences from the 'CoC audits' to the potential 'SLCA audits'.

The interviews started by investigating whether the auditor had the necessary experience in terms of issues that the auditor had audited against, in order to address whether the auditor had audited against the same aspects normally included in SLCA approaches (see Jørgensen et al. 2008). In addition the length of experience, the types of companies in which the auditor had performed audits, and the geographic locations were investigated. Also it was necessary to address whether the auditor had as a primary goal for the audit to illustrate the actual situation as accurately as possible, since if the goal was e.g. to 'please the supplier' which is actually heard of, the auditors potential contextual variation of the auditing procedure would not necessarily be performed in order to increase the validity of the audit.

As the auditor answered 'satisfactory' to these questions, the auditor was then asked whether, and if so, how and why the auditor changed procedures according to context.

The interview showed that the auditor in several ways varied his approach depending on the context. For example some companies in some countries did not have contracts, which according to the auditor did not mean that the employees were hired without contract, but simply that the 'standard' contract was avoided to circumvent the taxation rules. Instead of contracts the employees had 'small red books' where the contractual relationships between employer and employee were settled and therefore accepted by the auditor as a contractual relationship. The example thus shows that the issue of how contracts should be audited for depends on the context.

Another example related to the fact that not all companies had the same designations of occupation, implying that according to the auditor different occupational positions should be audited according to different issues in different contexts, and that procedures for whom to audit could therefore not be standardised.

A third example mentioned related to attempts by companies to cheat the auditor. The auditor for example mentioned that in some countries people were hired to look for westerners at the train stations to warn the companies before an auditor came. In other countries 'double bookkeeping' was a more favoured trick. The auditor thus had to pay special attention to certain issues in certain contexts to avoid these and other tricks.

As mentioned above, this is a very small investigation and does by no means give a full picture of the influence of context on how audits are being performed. Other experiences would probably be

reported by other auditors if interviewed, as was the original intent. However, the analysis does point to the possibility that performing a valid audit can be seen as workmanship and that the context will probably be significant for how the audit is performed.

### **3.3.3 Implication for the development of SLCA**

Taken together the above examples show how the context may influence the validity of assessing impacts and how these impacts affect the AoP, if not accounted for in the methodology. If referring to the list of how SLCA may lose validity in section 3, these issues relate to item 3 and 4 on the list, but it seems very likely that contextual variation may also be relevant for item 1 and 2, i.e. the identification of affected stakeholders and the identification of what impacts to include in the assessment, but no investigations on these issues were made.

To modify the SLCA methodology in order to cope with this contextual variation seems possible, however, identifying how the context more precisely should be accounted for in the methodology in every context seems like an enormous task. The importance of this contextual variation, in terms of loss of validity if not taken into account, is however difficult to assess and may be an issue for future studies to address.

Another issue is that if the contextual variation affects what is relevant to include in the assessment, the use of SLCA in a decision context may be hampered by differences in understanding, since what is important for the decision maker, coming from one context, may not be as important for the impacted stakeholder, coming from another context, and vice versa. This problem may potentially be mitigated by expressing the impacts on the AoP on a common denominator, as attempted by Weidema (2006), but such an approach may very easily become a question of ‘swings and roundabouts’, since introducing such models, at least with our present knowledge, is equally embedded with large uncertainties.



#### **4 How should SLCA be developed?**

It was primarily defined that the goal of this thesis is to contribute to the development of an SLCA that facilitates a positive effect on the stakeholders in the life cycle. To facilitate this goal, the SLCA should assess the social consequences of a decision as validly as possible and at the same time be as usable as possible in a decision making context. Studies were therefore performed to identify issues which could limit the usability of SLCA and its ability to validly assess the social consequences of a decision and based on this identification propose procedures to incorporate in the SLCA to alleviate the problems to the extent possible.

In relation to the usability of SLCA, which was only addressed in one study focusing on company use (see section 2), it was argued that SLCA has to be both attractive in terms of its outcome and feasible in terms of requirements to data and work. It was concluded that in terms of 'classical' ELCA uses, only the comparative assertion was found attractive by some of the interviewed companies. Other uses, such as a sheer use stage assessment and weighting tool were also mentioned by a few companies. The main barrier for its use seemed to be the accessibility of data about social impacts in the life cycle in remote up- and downstream tiers for example because of the unwillingness of suppliers to hand over this information to the companies.

To increase the usability, this study thus suggests that an increase in the accessibility of data is paramount. In this connection it was hypothesised that alleviating this problem simply by lowering the validity of data by e.g. using easier obtainable process related data will probably not increase the attractiveness of the methodology for external use since this would increase the risk for companies of being exposed as taking credit for an untrue assessment.

The question of validity was more extensively addressed in this thesis. Here it was shown that the question of ensuring validity is pertinent in all aspects of SLCA; from the identification of the stakeholders impacted, over the identifying and assessment of the complete range of impacts on these stakeholders to the assessment of how these impacts affect the AoP.

In line with this, one analysis of the validity of impact pathways showed how the incidence of child labour may not necessarily be a good measure for impacts on the defined AoP's in SLCA and on this basis that the direct adoption of international conventions like the ILO conventions may have limited validity as indicators in SLCA.

Furthermore it was demonstrated how the definition of the AoPs may entail the necessity of using subjective indicators to increase the validity, but which will also increase the demand for site-specific data.

It was furthermore showed that for the SLCA to assess validly the consequence of a decision, also the impacts of the 'non-implemented' life cycle should be assessed. An analysis showed that the impacts of the 'non-implemented' life cycle relate to impacts of unemployment on the workers who would have been employed in the life cycle of the assessed product. The 'non-implemented' life cycle would also cause impacts to the product user, who would be engaged in other activities, if not engaged with the assessed product.

Finally, it was addressed in section 3.3 how the assessment context may influence the possibility of establishing a universally valid SLCA, in that aspects such as data collection and the importance of endpoint categories may be influenced by context.

More or less concrete measures were suggested in order for SLCA to cope with these validity problems, however, common for all of these solutions were an increase in the work load to perform an SLCA, which in a world with scarce resources will make SLCA less usable. The analyses thus show that the increase in validity may come at a price in terms of loss of usability. On the other hand, the study addressing the usability of SLCA pointed towards the conclusion that for company users, the tasks to perform an SLCA may easily become infeasible even without the suggested

improvements on validity. It thus seems that there is a trade-off to be made between the emphasis on validity and usability of SLCA. To make such a trade-off it is necessary to know when SLCA is usable and valid enough. But at this point it is important to remember that SLCA may be used by different users, as pointed out in section 2.2, and that these different users may have different demands and possibilities when it comes to usability and validity: Some users may have high demands for validity and at the same time be willing to ‘pay the price’ in terms of applying a more complex methodology whereas others may be satisfied with simpler and less valid approaches. Thus, when considering the trade-off between validity and usability it seems that there should rather be a range of different SLCA approaches – a SLCA toolbox – fitting different users’ possibilities and needs. By developing SLCA to account for these different needs in terms of validity of SLCA, it seems that it may maximise the overall use of SLCA, which was stated as one of the necessary preconditions for SLCA to create a positive effect for the stakeholders in the life cycle of the assessed product. But as it was stated in section 1.3, it is not enough that the SLCA is being used; it should also be valid to the extent that it enables the decision maker to identify the decision alternative with the most favourable consequences implying that the SLCA should increase the decision maker’s possibility for choosing the decision alternative with the most favourable consequences in comparison to a random choice situation. Any SLCA not complying with this minimum demand can hardly be claimed to be decision support.

When considering the question of what procedures to incorporate in the SLCA to alleviate the problems of validity and usability, an answer is therefore that different approaches should be available for different users, but that the SLCA in any case should as a minimum be more valid than no assessment at all.

But what does that imply in relation to the findings in this study? Which, if any, of the above considered improvements to the validity of SLCA presented in section 3 are necessary in order for SLCA to comply with the criterion, and which are for the decision maker to decide when performing the assessment?

In most of the cases presented above, for example in the child labour case, it seems that even though the ‘incidence of child labour’ was not a very precise measure for impacts on the AoPs, it still seems reasonable to state that no child labour is better than child labour on average in terms of impacts on AoP. On average this information will therefore give the decision maker some guidance to perform the decision which will be better than having no information at all. Obviously using the more invalid indicators will decrease the validity of the assessment, but still a lot of uncertainty is needed before the assessment becomes as bad as a random choice. The same argument could be made with regards to the potentially missing subjective indicators as touched upon in section 3.1.1 and for the context dependency of the methodology, as introduced in section 3.3, since in both cases, objective indicators and standardised methodologies will still ‘point in the right direction’, even though probably not very precisely so.

Somewhat different is a lacking assessment of impacts related to the non-implemented life cycle in previous SLCA case studies. The reason is that since SLCA as presented here is to assess the consequence of a decision it should assess the difference between two or more alternatives. There is thus a need to assess alternatives to derive this difference. In this case this is then the difference between the implemented and non-implemented life cycle situation, as was outlined in section 3.2 (the question may become even more complex if considering a comparative assertion, see again section 3.2). But if this is the case then by only assessing the implemented life cycle situation, only a state is being measured, not a change, which is here assumed to be the goal. In other words, only assessing the implemented life cycle situation would e.g. be like answering the question ‘Will it become better?’ with the answer ‘It will be (e.g.) good’.

On this basis it thus seems that the assessment of both the implemented and the non-implemented life cycle is a methodological element which must be included if the SLCA is to comply with the minimum demand for validity.

However, if the impacts of the non-implemented life cycle were less important than the impacts of the implemented life cycle it could be argued that on average an assessment of only the impacts of the implemented life cycle would include the significant part of the total consequences and that the impacts of the non-implemented life cycle were therefore negligible in comparison. But considering that the health impacts of the non-implemented life cycle situation varying from 'increased mental health' to 'death', it seems that assuming them to be negligible is no more reasonable than dismissing the impacts of the implemented life cycle situation.

But this does not imply that the assessment of the non-implemented life cycle has to be as detailed as the assessment of the implemented life cycle (even though it seems that there are no reasons for not making it as nuanced, considering its importance). Simple approaches can probably be developed, for example based on average impacts of the non-implemented life cycle situation, as pointed out in section 3.2, which may provide a very superficial assessment but which will still be much more valid than assuming the impacts of the non-implemented life cycle to be non-existing, and will thus serve as an approach which will pass the minimum demand.

This implies that the only thing which *has* to be included in terms of validity of all the issues addressed is thus the assessment of the non-implemented life cycle. With regards to the other issues of e.g. whether to nuance the indicators for various impact categories, as exemplified in section 3.1, is a matter of trade-off between validity and usability demands for the user. This implies that the user is free to choose any of the proposed SLCA approaches presented in section 1.1 and include as many of the presented procedures for improving the validity as the user may see fit, as long as the user includes an assessment having even the faintest degree of validity of both the implemented and non-implemented life cycle situation.

However, one problem with this conclusion is that the user of the assessment may not necessarily be neutral with regards to the outcome of the assessment. For example considering a company applying SLCA for marketing purposes, as was suggested in section 2.1 to be the most likely use of SLCA in a company context, the company will have an interest in the assessment to show a certain result. By leaving the methodological decisions open for the users except for the demand to include an assessment of the non-implemented life cycle, as argued above, a large room for 'deciding' the outcome of the SLCA will be left to the user, for example through selecting and deselecting life cycle stages, impact categories and indicators giving the best assessment for the company. By such an imagined process where the methodology is shaped to give the 'right' outcome it does not seem that the above very loose methodology demands suffice, since if we consciously select data in favour of one alternative any information will not necessarily increase the likelihood that the decision maker will on average choose the alternative with the most favourable social impacts. It thus seems that when we are talking about non-neutral SLCA users, the demands have to be somewhat stricter than outlined above. Here the similar discussions taken in the ELCA community may be of use: In the ISO 14044 (2006), the international standard for performing ELCA's, it is stated that if a comparative assertion is to be disclosed to the public it should, among others, include an assessment of the completeness and uncertainties in the assessment as well as it should undergo a critical review from third party experts with involvement of stakeholders, with the goal of judging whether the result of the assessment could be different considering the uncertainties and completeness of the performed SLCA. By following such an approach it seems that the 'manoeuvrability' in order to get a certain result from the LCA (be it E or S) will be highly diminished, and it could therefore be a solution to the problem of handling non-neutral SLCA users,

and, since it is difficult to judge who is neutral and who is not in relation to the outcome of the SLCA, it should maybe apply to all publicly available uses of SLCA. This would then imply that not only should the SLCA include an assessment of the non-implemented LC situation in order to 'pass' the minimum validity demand, a suggestion could be that the SLCA should also include an assessment of the completeness and uncertainties of the SLCA in order to illustrate the certainty of the conclusion, when disclosed to the public.

However, in order for such solution to make any sense, it is necessary to have an understanding of what completeness implies in relation to SLCA and what the uncertainties in the assessment may be, pointing directly to the 4 research questions on validity raised in section 3, and followed up in section 3.1 to 3.3. In this thesis we have only opened the study of these issues, which deserve much more attention, as will be further discussed in the next chapter addressing topics for future research.

From an overall perspective the positive message from this discussion is thus that nothing found in this thesis hinders the development of an SLCA complying with the demands set, yet, much research are still needed, as will be discussed in the following section below. This being said it is however important to emphasise that SLCA inherently seems faced with significant problems, which may imply that it may never gain the same popularity as ELCA. The main problems is, as has been mentioned several times throughout the thesis, that environmental impacts tend to be more related to the process than social impacts, which will almost inevitably create some level of constraints to the combined level of usability and validity of SLCA in comparison to ELCA. The reason is as previously mentioned that social impacts, being less related to the nature of the process than environmental impacts, will not be identifiable to the same extent just on the basis of the bill of materials. Knowledge about how it has been produced becomes more important in SLCA in comparison to ELCA which more or less inevitably leads to more laborious procedures for performing an SLCA than an ELCA.

This limited correlation between process and social impact also implies that apart from being more laborious to perform, SLCA will also have some limitations to its functionality namely in relation to generic assessments of product types as is often made in ELCA. For such assessments SLCA will have a lower level of validity than an ELCA because the only information available will be the types of processes included in the life cycle.

A second limitation for SLCA in comparison to ELCA is that social impacts are not only occurring in connection to processes but happen in all life situations, which implies that in order to assess the consequences of a decision an assessment of the non-production/-use situation is needed, as discussed above. Other complicating factors may be the subjective experience of impacts (section 3.1.1) and, potentially, the issue raised about the lower degree of 'directness' of cause between product and social impacts (section 2.2), which are also particular to SLCA.

Taken together these difficulties may imply that both the development and the subsequent use of SLCA will be less successful than has been the case for ELCA.

## 5 Topics for future research

New technological achievements often allow the user to ‘see’ things which were before invisible to the senses. One example of this was the development of the telescope allowing astronomers to see things in the universe that no man had seen before. At least at that time, there were no possibilities to ‘go and have a look’ and the findings could therefore not be verified through the use of any other methods. A question that arose along these new insights was whether the small flying dots around Jupiter were in fact moons or just some unforeseen visual effect of the telescope lens. And since the findings could not be verified through other methods, the argumentation that it was in fact moons around Jupiter that were observed had to be made on the basis of the theories about the refraction of light in glass and planetary movements.

With regards to SLCA, we are in some regards in the same situation. SLCA can also be regarded as a technology that allows us to see things unseen before (the social consequences of a product’s life cycle) and which we do therefore not have any other methods to validate. But contrary to the case of the telescope where the scientists’ primary concerns were whether it showed how the world actually is, rather than the pretty pictures it revealed for the observer, it may be expected that the SLCA users will in some cases be more interested in the ‘pretty pictures’, rather than how the world actually is. Think for example of analysis of the company use of SLCA, who seemed most interested in SLCA as a marketing tool, and in this regard, what SLCA can offer is the ‘pretty picture’.

Furthermore, part of the development of SLCA is carried out at universities, and contrary to earlier times research on universities is not only about ‘the search for truth’. Governments financing the universities are trying to maximize the value of their money, meaning that also universities increasingly have to prove their own worth from a socio-economic perspective (Ziman 1996). The services that the universities provide thus have to sell. Needless to say, so is the situation in the consultancy or company world, where the development of SLCA also has been taking place. Taken together a situation can be envisioned where the services of SLCA are demanded by a user, who is mainly interested in how the results look, and some developers who may have no incentives to check the validity of the results if it is not essential for the assessment demand. And because no ordinary people will be able to check the SLCA results either, it can be imagined that such a system could be carried on for a very long time, where the only (and yet very central) problem is that the situation for the stakeholders in the life cycle is not improved or not improved as much as it could have been.

This is by no means an insinuation of any ill-will, but merely that the incentives for scientists or consultants for using probably several years of work to address these questions without creating incontrovertible knowledge may be difficult to justify. Neither is it claimed that this is the way the incentives always go in relation to SLCA, but merely that there is a possibility that they do. It thus seems that there is at least a risk that the focus on validity and thereby also the effect of SLCA may become shoved into the background which would imply that it would not be possible to perform an assessment of the completeness and uncertainties of the SLCA as was suggested to be necessary above and possibly to identify other concerns which have to be included in the assessment not identified in this thesis, like the assessment of the non-implemented life cycle situation. More research within this area is therefore strongly advocated for.

This thesis has as mentioned above only scratched the surface and more research can be performed on all the issues raised here. Other studies could for example address the validity of other indicators than the child labour indicators or address the influence of context on other issues than the variation in importance of endpoint categories or the data collection procedures.

But besides the issues already put forward in the analyses above, another issue which deserves careful attention is the degree of completeness of the assessment in terms of the types of impacts to

include in the SLCA. There seems to be almost an infinite number of ways in which for example a worker may experience impacts on his or her well-being (if this is taken to be the AoP), and it therefore seems difficult to get an overview of both type and the mutual importance of these. However, because of its importance to the overall validity of the SLCA, the issue of completeness would serve as a very relevant topic for future studies.

Another issue which has also received very little attention is the validity of various types of data. As it was discussed above, a very important issue in SLCA is to what extent social impacts are related to the nature of the process and/or the management of the company (Dreyer et al. 2006; Spillemaeckers et al. 2004). Using data related to the nature of the processes, like often used in ELCA, is obviously much more practical but is argued to be much less valid than site specific data (see also footnote 11), but no studies have yet been conducted addressing this important hypothesis. In this connection it is also important to remember that site specific data collected through social audits may be far from perfect (Pruett 2005, ETI Forum 2006, O'Rourke 2000). Considering that the data collection is a very central issue for conducting a SLCA it may be relevant to address the difference in validity that can be expected for the different types of data which might nuance the picture about whether it is always preferable to have site specific data or whether there may be situations where data on process averages may be equally satisfactory in terms of validity.

But besides the issues related directly to the ability of SLCA to assess validly the consequences of a decision and the usability of SLCA, some issues dealing with the more overall question of what it is that SLCA should do, should also be mentioned here.

In this project it has been argued that the goal of the SLCA is to have a positive effect on the stakeholders in the life cycle. If this goal is accepted there may be different ways in which the SLCA may have this positive effect as was argued in section 1.3. This thesis has addressed what was here defined as the 'direct effect', denoting an effect arising from decision makers following the advice of the assessment. The 'indirect effects' relate on the other hand to the potential effect of SLCA for example through creating incentives in the market for companies to perform well on the issues included in the SLCA; through increasing the awareness among SLCA users and audience about the social impacts of various activities; or through its development and use to feed into the academic or public debates, etc. Effects like these have to some extent been addressed in the CSR literature<sup>15</sup>, for example in relation to the effect of CoC's. Here it is shown that the effects for e.g. the workers in supply chains of setting demands about working conditions are mixed (Barrientos & Smith 2007; Lund-Thomsen 2008; Locke et al. 2006; Blowfield 1999). CoC's. One example is that even though the setting of standards for the workers in the supply chain may improve their conditions on issues like health and safety and working hours, issues like discrimination and the right to organise and collective bargaining may be much harder to affect (Barrientos & Smith 2007). Lund-Thomsen (2008) even argues that the effects on the worker of these initiatives to protect the worker may be outright negative.

Another and somewhat complex indirect effect of the use of SLCA is the so-called 'crowding out' effect, denoting a situation where norms expressed in the SLCA, displace the public regulation and legal accountability because companies to some extent take over (Bartley 2005).

If the goal of SLCA is to have a positive effect on the stakeholders in the life cycle, it is important that these issues are identified and handled to the extent possible in the design of the SLCA.

Addressing these issues may therefore serve as a relevant topic for future studies.

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<sup>15</sup> CSR is short for Corporate Social Responsibility. It is not unambiguously defined but Business for Social Responsibility has described CSR as the way in which a company operates towards its internal or external stakeholders in a manner that meets or exceeds the ethical, legal, commercial and public expectations that society has of business (Dahlsrud 2008).

Another topic which also addresses the question of what SLCA is supposed to do relates to the two different definitions of the AoP (see section 3.1.2), relating to 'human well-being' and to 'societal wealth'. The question that naturally arises is to what extent this is in fact the same or two different issues. We are thus to some extent in the somewhat backward situation where we are developing an assessment method without a clear notion of what it is we want to measure. One argument made in this regard is that the ultimate objective of societal wealth is actually human well-being and that an SLCA focusing on the assessment of societal wealth will, at least theoretically, be included in the assessment of human well-being. Whether this is the case or whether we are in fact dealing with two different aims and therefore assessment methodologies seem like a very relevant issue for future studies, especially when it is considered that the effect SLCA may have, regardless of whether we speak of direct or indirect impacts, is dependent on the definition of the AoP.

Addressing these questions about what SLCA is to assess and ensuring that this is assessed in a valid manner will without doubt be complex and laborious to analyse. But despite the complexity it is my hope that the future development of SLCA, to the extent that it will be continued, will focus on these issues in order to ensure that SLCA will not merely become a new manipulation tool as it was provocatively suggested to be on the first page of this thesis.

## 6 References

- Akrich M (1992): The De-Description of Technical Objects. Bijker W and Law J, eds., *Shaping Technology* (Cambridge, MA, MIT Press, 1992), 205-224.
- Akrich M, Callon M, Latour B (2002): The key to success in innovation. Part 1: The art of interesement. *International Journal of Innovation Management* 6 (2) 187-206
- Akrich M, Callon M, Latour B (2002): The key to success in innovation. Part 2: The art of choosing good spokespersons. *International Journal of Innovation Management* 6 (2) 207-225
- Andrews E, Lesage P, Benoît C, Parent J, Norris G, Revéret JP (2009): Life cycle attribute assessment: Case study of Quebec greenhouse tomatoes. *Journal of Industrial Ecology* 13 (4) 565-578
- Barrientos S, Smith S (2007): Do Workers Benefit from Ethical Trade? Assessing codes of labour practice in global production systems. *Third World Quarterly* 28 (4) 713-729
- Barthel L, Wolf MA, Eyerer P (2005): Methodology of Life Cycle Sustainability for Sustainability Assessments. Presentation on the 11th Annual International Sustainable Development Research Conference (AISDR), 6th – 8th of June 2005, Helsinki, Finland
- Bartley T (2005): Corporate Accountability and the Privatization of Labor Standards: Struggles over Codes of Conduct in the Apparel Industry. *Research in Political Sociology* 14 211-244
- Benoît C, Mazijn B (2009): Guidelines for Social Life Cycle Assessment of Products. UNEP/SETAC Life Cycle Initiative. Druk in de weer, Belgium
- Blowfield M (1999): Ethical trade: A review of developments and issues. *Third World Quarterly* 20 (4) 753-770
- Brundtland GH (1987): *Our Common Future: Report of the World Commission on Environment and Development*. Oxford University Press. Oxford, UK. <http://www.worldinbalance.net/pdf/1987-brundtland.pdf>
- Burrell G, Morgan G (1979): *Sociological paradigms and organisational analysis*. Ashgate Publishing Limited, Aldershot, England
- Cañequé FC (2002): Evaluación de la situación laboral de empresas : El Análisis del Ciclo Vida como herramienta para el Desarrollo Sostenible. Departamento de Economía i Organización de Empresas, Universitat de Barcelona, Barcelona, Spain
- Carmines EG, Zeller RA (1979): *Reliability and Validity Assessment: Reliability and Validity Assessments*. Sage, Beverly Hills, USA
- Chiricos TG (1987): Rates of crime and unemployment: An analysis of aggregate research evidence. *Social Problems* 34 (2) 187-212



CSR monitor (2006): <<http://www.csmonitor.com/2006/1222/p01s03-wosc.html>>

Cummins RA (2000): Objective and Subjective Quality of Life: An Interactive Model. *Social Indicators Research* 52 (1), p 55-72

Cummins RA (2005): Moving from the quality of life concept to a theory. *Journal of Intellectual Disability Research* 49 (10) p 699-706

Dahlsrud A (2008): How Corporate Social Responsibility is Defined: an Analysis of 37 Definitions. *Corporate Social Responsibility and Environmental Management* 15 (1) 1–13

Diener E, Biswas-Diener R (2002): Will money increase subjective well-being? *Social Indicators Research* 57 (2) 119-169

Dreyer L, Hauschild M, Schierbeck J (2006): A Framework for Social Life Cycle Impact Assessment. *International Journal of Life Cycle Assessment* 11 (2) 88-97

Dreyer L, Hauschild M, Schierbeck J (2009): Characterisation of social impacts in LCA – Implementation in six case studies. Submitted to the *International Journal of Life Cycle Assessment*

ETI Forum (2006): Getting smarter at auditing. Tackling the growing crisis in ethical trade auditing. Report from ETI members' meeting 16 November 2006

Evans A, Lesage P, Benoît C, Parent J, Norris G, Revéret JP (2009): Life Cycle Attribute Assessment - Case Study of Quebec Greenhouse Tomatoes. *Journal of Industrial Ecology* 13 (4) 565-578

Flysjö A (2006): Indicators as a Complement to Life Cycle Assessment - A Case Study of Salmon. Presentation held 17<sup>th</sup> of June 2006 in Lausanne

Freeman RB (1999): The economics of crime. *Handbook of Labor Economics*, volume 3, chapter 52. Edited by O. Ashenfelter and D. Card. Elsevier Science.

Gauthier C (2005): Measuring Corporate Social and Environmental Performance: The Extended Life-Cycle Assessment. *J Bus Ethics* 59 (1-2) 199-206

Hakim C (1982): The social consequences of high unemployment. *Journal of Social Policy* 11(4) 433-467

Hunkeler D (2006): Societal LCA Methodology and Case Study (12 pp). *International Journal of Life Cycle Assessment* 11 (6) 371-382

ISO 14044:2006 (2006): Environmental management – Life cycle assessment – Requirements and guidelines. International Standard Organisation, Geneva, Switzerland

Jenaro C, Verdugo MA, Caballo C, Balboni G, Lachapelle Y, Otrebski W, Schalock RL (2005): Cross-cultural study of person-centred quality of life domains and indicators: a replication. *Journal of Intellectual Disability Research* 49(10) 734-739

- Jørgensen A, Le-Boqc A, Nazakina L, Hauschild M (2008): Methodologies for Social Life Cycle Assessment. *International Journal of Life Cycle Assessment* 13 (2) 96-103
- Jørgensen A, Hauschild M, Jørgensen MS, Wangel A (2009a): Relevance and Feasibility of Social Life Cycle Assessment from a Company Perspective. *International Journal of Life Cycle Assessment* 14 (3) 204-214
- Jørgensen A, Lai LCH, Hauschild M (2009b): Assessing the validity of impact pathways for child labour and well-being in Social Life Cycle Assessment. *International Journal of Life Cycle Assessment* 15 (1) 5-16
- Jørgensen A, Finkbeiner M, Hauschild M (2010): Defining the baseline in Social Life Cycle Assessment. *International Journal of Life Cycle Assessment* 15 (4) 376-384
- Locke R, Qin F, Brause A (2006): Does Monitoring Improve Labour Standards? Lessons from Nike. Corporate Social Responsibility Initiative, working paper no. 24. John F Kennedy School of Government, Harvard University, Cambridge, US
- Lund-Thomsen P (2008): The Global Sourcing and Codes of Conduct Debate: Five Myths and Five Recommendations. *Development and Change* 39(6) 1005–1018
- Manhart A, Griebhammer R (2006): Social impacts of the production of notebook PCs – Contribution to the development of a Product Sustainability Assessment (PROSA). Öko-Institut e.V., Freiburg, Germany
- Mclean C, Carmona C, Francis S, Wohlgemuth C , Mulvihill C (2005): Worklessness and health – what do we know about the causal relationship? Evidence review. Health Development Agency. <[http://www.nice.org.uk/niceMedia/documents/worklessness\\_health.pdf](http://www.nice.org.uk/niceMedia/documents/worklessness_health.pdf)>
- Méthot A (2005): FIDD: A green and socially responsible venture capital fund. Presentation on the Life Cycle Approaches for Green Investment - 26th LCA Swiss Discussion Forum, 2005, Lausanne, Switzerland
- Natale SM, Ford JW (1994): The social audit and ethics. *Managerial Auditing Journal* 9(1) 29-33
- Nazarkina L, Le Bocq A (2006): Social aspects of Sustainability assessment: Feasibility of Social Life Cycle Assessment (S-LCA). EDF 2006, Moret-sur-Loing, France
- Norris GR (2006): Social Impacts in Product Life Cycles - Towards Life Cycle Attribute Assessment. *International Journal of Life Cycle Assessment* 11 (1) (special issue) 97-104
- O'Rourke D (2000): Monitoring the monitors: A critique of PricewaterhouseCoopers (PwC) labor monitoring. Massachusetts Institute of Technology. Working paper
- Pruett (2005): Looking for a quick fix: How weak social auditing is keeping workers in sweatshops. Clean Clothes Campaign. <[http://www.eu-china.net/web/cms/upload/pdf/materialien/ccc\\_2005\\_quick\\_fix\\_08-04-29.pdf](http://www.eu-china.net/web/cms/upload/pdf/materialien/ccc_2005_quick_fix_08-04-29.pdf)>

Schalock RL (1996): Reconsidering the Conceptualization and Measurement of Quality of Life. In: Quality of Life, Volume I: Conceptualization and Measurement. American Association on Mental Retardation, Washington DC, US.

Schalock RL, Verdugo MA, Jenaro C, Wang M, Wehmeyer M, Jiancheng X, Lachapelle Y (2005): Cross-Cultural Study of Quality of Life Indicators. American Journal of Mental Retardation 110(4) 298-311

Schmidt I, Meurer M, Saling P, Kicherer A, Reuter W, Gensch C (2004): SEEbalance - Managing Sustainability of Products and Processes with the Socio-Eco-Efficiency Analysis by BASF. Greener Management International (45) 79-94

Sirgy MJ, Michalos AC, Ferriss AL, Easterlin RA, Patrick D, Pavot W (2006): The Quality-of-Life (QOL) Research Movement: Past, Present, and Future. Social Indicator Research 76 (3) 343-466

Spillemaeckers S, Vanhoutte G, Taverniers L, Lavrysen L, van Braeckel D, Mazijn B, Rivera JD (2004): Integrated Product Assessment - The Development of the Label 'Sustainable Development' for Products Ecological, Social and Economical Aspects of Integrated Product Policy. Belgian Science Policy, Belgium

Ström S (2003): Unemployment and families: A review of research. Social Service Review 77 (3) 399-430

Thiesen J, Christensen TS, Kristensen TG, Andersen RD, Brunoe B, Gregersen TK, Thrane M, Weidema BP (2008) · Rebound Effects of Price Differences. Int J LCA 13(2) 104-114.

Udo de Haes HA, Jolliet O, Finnveden G, Hauschild M, Krewitt W, Müller-Wenk R (1999): Best Available Practice Regarding Impact Categories in Life Cycle Assessment. International Journal of Life Cycle Assessment 4 (2) 66-74

Waddell G, Burton KA (2006): Is work good for your health and well-being? TSO. London, UK <<http://www.workingforhealth.gov.uk/documents/is-work-good-for-you.pdf>>

Weidema BP (2005): ISO 14044 also Applies to Social LCA. International Journal of Life Cycle Assessment 10 (6) 381-381

Weidema BP (2006): The integration of Economic and Social Aspects in Life Cycle Impact Assessment. International Journal of Life Cycle Assessment 11 (1) (special issue) 89-96

Weidema BP, Ekvall T (2009): Guidelines for applications of deepened and broadened LCA. Chapter for CALCAS deliverable D18. <[http://www.lca-net.com/files/consequential\\_LCA\\_CALCAS\\_final.pdf](http://www.lca-net.com/files/consequential_LCA_CALCAS_final.pdf)>

Wenzel H, Hauschild M, Alting L (1997): Environmental assessment of products. Vol. 1 - Methodology, tools and case studies in product development. First edition. Chapman & Hall, United Kingdom, Kluwer Academic Publishers, Hingham, MA, USA

WHO (1995): The World Health Organization Quality of Life Assessment (WHOQOL): Position Paper From the World Health Organization. *Social Science and Medicine* 41 (10) 1403-1409

Ziman J (1996): Is science losing its objectivity? *Nature* 382 (6594) 751-754

Ziman J (1998): Why must scientists become more ethically sensitive than they used to be? *Science* 282 (5395) 1814-1815



## 7 Appendix 1: Publications, posters and oral presentations

### **Publications in international journals (included in the PhD thesis)**

Jørgensen A, Le-Boqc A, Nazakina L, Hauschild M (2008): Methodologies for Social Life Cycle Assessment. *International Journal of Life Cycle Assessment* 13 (2) 96-103

Jørgensen A, Hauschild M, Jørgensen MS, Wangel A (2009a): Relevance and Feasibility of Social Life Cycle Assessment from a Company Perspective. *International Journal of Life Cycle Assessment* 14 (3) 204-214

Jørgensen A, Lai LCH, Hauschild M (2009b): Assessing the validity of impact pathways for child labour and well-being in Social Life Cycle Assessment. *International Journal of Life Cycle Assessment* 15 (1) 5-16

Jørgensen A, Finkbeiner M, Hauschild M (2010): Defining the baseline in Social Life Cycle Assessment. *International Journal of Life Cycle Assessment* 15 (4) 376-384

### **Publications in international journals (not included in the PhD thesis):**

Hauschild M, Dreyer LC, Jørgensen A (2008): Assessing the Social Impacts in a Product's Life Cycle. *CIRP Annals – Manufacturing Technology*. 57 (1) 21-24

Traverso M, Jørgensen A, Finkbeiner M (2010): Life Cycle Sustainability Dashboard. Submitted to the *Journal of Industrial Ecology*

### **Oral presentations at conferences and seminars**

Jørgensen A, Hauschild M (2007): Assessing the social impacts of the biofuel life cycle. *Biofuel Assessment, Modelling Global Land Use and Social Implications in the Sustainability Assessment of Biofuels*, 4-5 of June 2007, Copenhagen

Jørgensen A (2007): How should the Social Life Cycle Assessment be developed – the user perspective. *Cycle2007, 3<sup>rd</sup> Canadian Forum on the Life Cycle Management of Products and Services*, 22-23 of October 2007, Montreal, Canada

Jørgensen A (2008): On the possibility of developing accurate indicators for SLCA – the example of child labour. *15th LCA Case Studies Symposium*, 22-23 January 2008.

Jørgensen A (2009): The Social Life Cycle Assessment. Seminar at the Technical University of Berlin 9<sup>th</sup> of October 2009, Berlin, Germany

### **Poster presentations at conferences**

Jørgensen A, Le-Boqc A, Nazakina L, Hauschild M (2008): Review of methodologies for Social LCA. *Setac Europe - 18, 2008, Warsaw, Poland*

### **Miscellaneous**

Participant at two meetings in the UNEP-SETAC taskforce on the integration of social aspects into LCA.

Peer reviewer on the *Journal of Industrial Ecology* from 2009



## **8 Appendix 2: Methodologies for Social Life Cycle Assessment**

Jørgensen A, Le-Boqc A, Nazakina L, Hauschild M (2008): Methodologies for Social Life Cycle Assessment. *International Journal of Life Cycle Assessment* 13 (2) 96-103



## Societal LCA (Subject Editor: David Hunkeler)

# Methodologies for Social Life Cycle Assessment\*

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DOI: <http://dx.doi.org/10.1065/lca2007.11.367>

Please cite this paper as: Jørgensen A, Le Bocq A, Nazarkina L, Hauschild M (2007): Methodologies for Social Life Cycle Assessment. Int J LCA, DOI: <http://dx.doi.org/10.1065/lca2007.11.367>

### Abstract

**Goal, Scope and Background.** In recent years several different approaches towards Social Life Cycle Assessment (SLCA) have been developed. The purpose of this review is to compare these approaches in order to highlight methodological differences and general shortcomings. SLCA has several similarities with other social assessment tools, although, in order to limit the expanse of the review, only claims to address social impacts from an LCA-like framework are considered.

**Main Features.** The review is to a large extent based on conference proceedings and reports, which are not all easily accessible, since very little has been published on SLCA in the open literature. The review follows the methodological steps of the environmental LCA (ELCA) known from the ISO 14044 standard.

**Results.** The review reveals a broad variety in how the approaches address the steps of the ELCA methodology, particularly in the choice and formulation of indicators. The indicators address a wide variety of issues; some approaches focus on impacts created in the very close proximity of the processes included in the product system, whereas others focus on the more remote societal consequences. Only very little focus has been given to the use stage in the product life cycle.

Another very important difference among the proposals is their position towards the use of generic data. Several of the proposals argue that social impacts are connected to the conduct of the company leading to the conclusion that each individual company in the product chain has to be assessed, whereas others claim that generic data can give a sufficiently accurate picture of the associated social impacts.

**Discussion.** The SLCA approaches show that the perception of social impacts is very variable. An assessment focusing on social impacts created in the close proximity of the processes included in the product system will not necessarily point in the same direction as an assessment that focuses on the more societal consequences. This points toward the need to agree on the most relevant impacts to include in the SLCA in order to include the bulk of the situation.

Regarding the use of generic data as a basis for the assessment, this obviously has an advantage over using site specific data in relation to practicality, although many authors behind the SLCA

approaches claim that reasonable accuracy can only be gained through the use of site specific data. However, in this context, it is important to remember that the quality of site specific data is very dependent on the auditing approach and, therefore, not necessarily of high accuracy, and that generic data might be designed to take into account the location, sector, size and maybe ownership of a company and thereby in some cases give a reasonable impression of the social impacts that can be expected from the company performing the assessed process.

**Conclusions.** This review gives an overview of the present development of SLCA by presenting the existing approaches to SLCA and discussing how they address the methodological aspects in the ISO standardised ELCA framework. The authors found a multitude of different approaches with regard to nearly all steps in the SLCA methodology, thus reflecting that this is a very new and immature field of LCA.

**Recommendations and Perspectives.** SLCA is in an early stage of development where consensus building still has a long way. Nevertheless, some agreement regarding which impacts are most relevant to include in the SLCA in order to cover the field sufficiently seems paramount if the SLCA is to gain any weight as a decision support tool. Furthermore, some assessment of the difference between site specific and generic data could give valuable perspectives on whether a reasonable accuracy can be gained from using generic data or whether the use of site specific data is mandatory and, if so, where it is most important.

**Keywords:** Environmental life cycle assessment (ELCA); generic data; indicators; product life cycle; review; site-specific data; social life cycle assessment (SLCA)

### Introduction

The debate on sustainable development has spurred initiatives on methods for assessing environmental, social and economic impacts. In relation to this development, there has been an increasing interest for the inclusion of social aspects into the environmental life cycle assessment of products and systems in recent years. This task has been commenced in the development of the so-called Social Life Cycle Assessment (SLCA). Experience with SLCA is growing and is be-

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ing developed to include a multitude of impacts, ranging from direct impacts on workers to broader societal consequences. Decision-makers from several different areas have found interest in SLCA, such as decision-makers on investment (Methot 2005), design (Schmidt et al. 2004, Gauthier 2005), industrial management (Cañeque 2002, Schmidt et al. 2004, Dreyer et al. 2006, Nazarkina and Le Bocq 2006), consumers (Spillemaeckers et al. 2004) and public decision making (Hunkeler 2006). Also, a number of methodologies have been created without a specified target group of users (Barthel et al. 2005, Flysjö 2006, Manhart and Griebshammer 2006, Norris 2006, Weidema 2006). Furthermore, SLCA-like Internet databases are under development, having the goal to make data broadly and easily accessible to a wide range of users (Earthster 2007). Because of the limited, available descriptions, this initiative will not be discussed any further.

In this review we try to draw a picture of the present landscape of SLCA by analysing the existing methodology and proposals for SLCA based on the sources mentioned above. Especially the report made by Nazarkina and Le Bocq (2006), which was already a review and analysis of SLCA methodologies, has served as a basis for this article.

The review is based on a thorough literature survey including journal papers and, in particular, less easily accessible sources like conference proceedings and reports, as very little has been published until now in peer-reviewed journals.

The review attempts to highlight the general points of agreement and disagreement among the authors and tries to give a specific focus on the methodological shortcomings, thereby giving a picture of the degree of maturity in the already available proposals.

The presentation and discussion of the methodologies follows the general methodological framework of the SLCA as proposed by the UNEP-SETAC Life Cycle Initiative Cross cutting taskforce 3 on integration of social aspects in LCA, similar to the framework for Environmental LCA (ELCA) laid out by ISO 14040, namely: Goal definition; scope definition; inventory analysis; and impact assessment (Griebshammer et al. 2006). The interpretation phase will not be discussed here.

SLCA is developing in a scientific field with many parallels to methodology discussions in Cost Benefit Analysis (CBA), Social Impact Assessment (SIA), social accounting and others. It was chosen in the review only to include methodology proposals that claim to assess social impacts based on an LCA-like framework. A consequence of this approach is the omission of methodology proposals with no claimed connection to LCA methodology, even though they may have some relevance to the overall goals of SLCA.

## 1 Goal definition of an SLCA study

In spite of their short history, SLCA-approaches have already been developed to support several different goals. As in ELCA, two main classes of goals can be identified. One is product, process or company comparison, herein also labelling and social responsible investments, as exemplified by Schmidt et al. (2004), Spillemaeckers et al. (2004), Méthot

(2005). The other class is identification of product or process improvement potentials (Flysjö 2006, Gauthier 2005, Dreyer et al. 2006, Manhart and Griebshammer 2006). These classes of goals should be seen as complementary. Different goals have implications for the methodological possibilities and limitations, which will be discussed in the following. Still, several of the approaches do not specify one specific goal, such as Barthel et al. (2005), Norris (2006) and Weidema (2006).

## 2 Scope definition of an SLCA study

The objective of the scope definition is to identify and to define the object of the study and to delimit the assessment. In this section, the origin of social impacts, allocation, system boundary setting and social indicators will be discussed.

### 2.1 The origin of social impacts

Product systems or service systems are often composed of many processes. In ELCA it is generally accepted that the environmental impacts arise because of the nature of these processes. In other words, there is a causal link between process and environmental impact. The environmental assessment, thus, is based on an aggregated inventory of input and output for processes that are needed to provide the function defined in the functional unit.

Regarding SLCA, on the other hand, it has been discussed whether this is a valid approach. Dreyer et al. (2006) and Spillemaeckers et al. (2004), for example, argue that most social impacts have no relation to the processes themselves, but rather to the conduct of the companies performing the processes. The causal link is therefore not from process to social impact, but from conduct of the company to the social impact. They argue therefore that the SLCA inventory analysis should be focused on the companies involved in the product system. Schmidt et al. (2004), on the other hand, maintain that the focus on the process is the basis for the assessment as used in the ELCA.

### 2.2 Allocation

The discipline of allocation in ELCA deals with the division of impacts between the product system under study and one or more other product systems with which it interacts. Following this definition, allocation in SLCA has been addressed in relation to the above question of the origin of impacts. The problem that arises with regard to the approach presented by Spillemaeckers et al. (2006) and Dreyer et al. (2006) is how much of the company's total social impacts should be allocated to the process included in the assessed product or service.

Dreyer et al. (2006) propose that a share of the total amount of impacts created by the company involved in the product system should be allocated to the assessed product or service, and that the share should be determined by the weight that the company is given in the product's or service's total product chain. The share factor or allocation principle could be based on value creation, number of labour hours spent or the like.

A rather different approach towards allocation is taken in the socio-labelling initiative presented by Spillemaeckers et al. (2004). In this approach, each company included in the assessment has to comply with the standard set by the label. If the standard is met, the label can be awarded. As it is the whole company that is assessed, no allocation needs to be made, regardless of the fact that some of the company's processes might not be involved in the life cycle of the assessed product or service.

### 2.3 System boundaries

With the goal to support management decisions, the approaches presented by Méthot (2005) and Dreyer et al. (2006) narrow their focus to those parts of the life cycle that the company performing the assessment can influence directly. The application of the SLCA thereby justifies that only the company and its closest suppliers and distributors are assessed. Schmidt et al. (2004), on the other hand, focus on product comparison, and, since relevant impacts can be located in all parts of the chain, a full life cycle assessment is necessary.

As in ELCA, cut-off criteria are used in SLCA to set boundaries. In the Sustainable Development label (Spillemaeckers et al. 2004), the cut-off criteria depend on the expert judgement. Another more formalised approach proposed by Barthel et al. (2005) is to use the ISO 14044 (2006) definition of cut-off criteria in LCA, substituting the words 'environmental significance' with 'social significance'. The ISO 14044 definition, if a process contributes more than a certain defined amount to a given quality, implies that the process has to be included.

In line with this statement, Weidema (2005) advocates the need to apply the ISO 14044 framework also in boundary setting in SLCA, implying that the exclusion of life cycle stages, processes, inputs or outputs is only permitted if it does not significantly change the overall conclusions of the study.

### 2.4 Social indicators

In Table 1 and 2, the different SLCA approaches are characterised according to the impact categories they include, stating the number and type of indicators for each impact category. The indicator type refers to whether it is quantitative or qualitative/descriptive. Quantitative indicators can be based on measurements in physical units, semi-quantitative scores, or yes/no scores.

Some SLCA approaches use midpoint indicators, others use endpoint indicators. This difference refers to the location of the indicators in the impact pathway. For example, job creation is normally not considered a goal in itself but, through contributing to the family income and subsequent poverty reduction, it may improve the family's health conditions, which may be considered as an end goal. In this example, the job creation could thus be considered a midpoint indicator, and the health condition as the endpoint indicator. The two types of indicators are in principle linked by a so-called impact pathway describing the cause-effect relationship be-

tween mid-point and endpoint, but this relationship is often difficult to express. The two classes of SLCA approaches are thus presented in separate tables.

In the midpoint-based approaches, there is a great variety of issues being included. Because of the limited scope of this article, it has been necessary to create some generalised impact categories inspired from the Global Reporting Initiative (2007), thereby reducing the original complexity somewhat. Because of the close relation between several of the impact categories, and due to the sometimes superficial description of the indicators in the documentation, the categorisation of the indicators may be debatable in some cases. For a more complete picture, the reader is thus referred to the original sources.

Furthermore, in several of the midpoint-based approaches, the indicators are not shown. In these cases, the type and number of indicators included on the impact categories have been deduced from statements about what is considered in the SLCA approach.

Table 1 shows the highest frequency for indicators concerning discrimination and physical working conditions. Depending on the scope of the SLCA, the inclusion of the impact categories concerning other human rights, society and labour practices, and decent work conditions, appears to be the next priority.

As pointed out by Nazarkina and Le Bocq (2006), indicators are generally defined at the level of the organisation and not at the level of the individual. For example, the individual conflicts between manager and employees are generally not considered.

It is also noticeable that the impact categories which only allow negative scores are predominant in the mid-point based approaches. In relation to forced labour, for example, it would not be possible to obtain a 'good score', but merely to vary from OK (no forced labour) to poorer.

Only two SLCA approaches have been identified using endpoint indicators (see Table 2), and these are rather different, so it is difficult to point out any trends.

As has been mentioned, some of the approaches use midpoint and some endpoint indicators. Which type of indicator to use is an ongoing discussion in the field of ELCA, although it may yet become even more relevant in SLCA. Endpoint indicators have the advantage that they can reflect the potential damage or benefit to the valued item, known as the Area of Protection of the LCA (see below for further explanation), having the advantage, in theory, that no subjective weighting is needed. However, connecting the stressors that create the impacts and the Areas of Protection requires that the impact pathway is established. It has to be quantifiable and stable. Weidema (2006) states that these impact pathways can be established to an acceptable level of accuracy. Because midpoint indicators are closer to the stressors and also more understandable for decision makers, Dreyer and Flysjö state that these are to be preferred (Grießhammer et al. 2006).

**Table 1:** Impact categories and indicators at midpoint level

Impact categories	Number of indicators, quantitative/descriptive (q/d):											
	Barthel et al.	Carneque	Dreyer et al. <sup>1</sup>	Flysjö <sup>2</sup>	Gauthier	Hunkeler	Manhart & Griefhammer	Méthot <sup>3</sup>	Le Bocq <sup>4</sup>	Nazarikina & Schmidt et al.	Spillemaeckers <sup>5</sup>	Included in approaches
<b>Human rights</b>												
Non-discrimination, including indicators on diversity, such as composition of employees on all levels according to gender, age group, disabled, part-time workers and other measures of diversity	2,q	10,q	1,q	3,q	1,d		1,d	?,q	4,q	5,q	2,q	10
Freedom of association and collective bargaining	2,q		1,q	1,d			1,d	?,q	1,q	1,q	8,q	8
Child labour, including hazardous child labour	2,q		1,q	1,d			1,d		1,q	1,q	3,q	7
Forced and compulsory labour	1,q		1,q	1,d			1,d		1,q	1,q	3,q	7
<b>Labour practices and decent work conditions</b>												
Wages, including equal remuneration on diverse groups, regular payment, length and seasonality of work and minimum wages	1,q	3,q		6,q 1,d			2,d	?,q	4,q	1,q	5,q	8
Benefits, including family support for basic commodities and workforce facilities				1,d		1,q	1,d		6,q	4,q		5
Physical working conditions, including rates of injury and fatalities, nuisances, basal facilities and distance to workplace	2,q	2,q	1,q	2,q 3,d	1,d		1,d	?,q	4,q	6,q	9,q	10
Psychological and organisational working conditions, such as maximum work hours, harassments, vertical, two-way communication channels, health and safety committee, job satisfaction, and worker contracts				1,d	1,d		2,d		10,q	1,q	8,q	6
Training and education of employees		2,q		2,d	1,d		1,d	?,q	6,q	1,q	2,q	8
<b>Society</b>												
Corruption, including incidents/press reports concerning fraud, corruption and illegal price-fixing, and violation of property rights.					1,d		2,d		2,q	1,q		4
Development support and positive actions towards society, including job creation, support of local suppliers, general support of developing countries, investments in research and development, infrastructure, and local community education programmes	6,q			1,q			12,d	?,q	12,q	8,q	5,q	7
Local community acceptance, such as complaints from society, and presence of communication channels					1,d			?,q	4,q	1,q	5,q	5
Ensuring of commitment to sustainability issues from and towards business partners							2,d				6,q	2
<b>Product responsibility</b>												
Integration of customer health and safety concerns in product, such as content of contaminants/nutrients, other threats/benefits to human health (including special groups) due to product use, and complaint handling system				2,q	1,d					5,d	1,q	4
Information about product to users, such as labelling, information about ingredients, origin, use, potential dangers, and side effects.										1,q 2,d	2,q	2
Marketing communications, such as ethical guidelines for advertisements										1,d		1

**Table 2:** Impact categories and indicators at endpoint level

Impact categories	Number of indicators, quantitative/descriptive (q/d)	
	Norris	Weidema <sup>6</sup>
Mortality	1,q	?
Morbidity	1,q	?
Autonomy		15?,q
Safety, security and tranquillity		6?,q
Unequal opportunities		?
Participation and influence		?

The numbers, d, and q in Table 1 and 2 refer to the number of indicators included on the given impact category, and whether the indicators are descriptive (qualitative) or quantitative

<sup>1</sup> Dreyer et al. (2006) include both some universal indicators and some site-specific indicators that are defined locally. Only the former, which all address human rights of the workers are included in the table. Several of these, however, do also address impact categories included under the 'labour practices and decent work conditions' category.

<sup>2</sup> Flysjö (2006) includes some economic indicators not included in the table. These are: Production costs, values added and government subsidies.

<sup>3</sup> The SLCA-FIDD tool (Méthot 2005) is based on a questionnaire comprising more than 200 questions. The questionnaire is confidential and it is therefore difficult to state the exact number of indicators for each impact category included.

<sup>4</sup> The list of indicators is a summary based on many of the other SLCA approaches.

<sup>5</sup> Spillemaeckers et al. (2004) also include several indicators concerning environmental, overall management issues, such as compliance with legislation, that are not included in the table.

<sup>6</sup> Only examples of indicators are given in Weidema, 2006, hence the question marks.



Regarding impacts on the consumer in the use stage, very few impact categories are suggested. This may be due to the fact, as Dreyer et al. (2006) states, that the potential social impacts in the use stage are as different and variable as the products themselves. Flysjö (2006) uses the content of Omega 3 fatty acids in the salmon to illustrate one positive impact that the product might impose on the user. Griebshammer et al. (2006) agrees that the use stage is very difficult to assess and emphasizes the importance of the definition of the functional unit in this context. The function of the product or service should be defined in detail, both in quantity and quality in order to show qualities as time requirement, convenience and prestige. A quite parallel proposal is made by Dreyer et al. (2006) who suggest to including impact categories for the use stage on the basis of established product categories. Moreover, Griebshammer et al. (2006) mention, to the extent possible, that impact categories on the use stage should be chosen in accordance with internationally recognised texts on consumer impacts.

#### 2.4.1 Area of protection

The creation of indicators implies a notion of some underlying themes of importance or, in this case, something that needs to be protected, consequently denoted as Areas of Protection (AoP). In ELCA there are four of these AoP, namely human health, natural environment, natural resources, and man-made environment (Udo de Haes et al. 2002).

However, several authors argue, when it comes to SLCA, that these AoPs do not suffice. Dreyer et al. (2006) have a lengthy discussion of the areas of protection considered in SLCA and the suitability of the traditional AoPs from ELCA to the impact assessment in SLCA. They propose a new area of protection: 'Human dignity and well being' to supplement the 'Human health' AoP addressed in ELCA. Weidema (2006) also discusses AoPs and concludes quite comparably to include not only human health but also its well-being.

#### 2.4.2 Formulation of indicators

In the formulation of indicators for the categories of social impact, two important distinctions between the different methodologies become apparent. The first relates both whether the indicators are formulated in quantitative, semi-quantitative or qualitative terms. The second distinction concerns whether the indicator measures the impact directly or whether indirect indication or proxy measurements are applied.

When formulating quantitative indicators, it is assumed that the phenomenon to be measured can be directly quantified allowing for the application of units in time, cases or the like. Barthel et al. (2005), for example, propose using two indicators for measuring the impact category 'health and safety'. Both are based on statistical sources, one on the incidence of lethal injuries and one on the non-lethal injuries, implying a formulation of the indicator as being the number of lethal or non-lethal injuries, which allows for measurements in the metric 'cases per process'.

A scoring system, on the other hand, is often applied if the phenomena to be measured are too complex to measure and express in simple physical units. The scoring system typically

presents ratings on semi-quantitative scales, for example ratings from good to bad, often expressed in corresponding numbers. An example could be the indicators used to measure the performance on 'occupational health and safety' in the approach presented by Spillemaeckers et al. (2004). They also use statistical sources on the frequency of accidents as in the above example, but include indicators on the presence of health and safety training of employees, presence of a health and safety committee, presence of a formal policy on health and safety, and several other indicators that are translated into numbers through the use of scoring systems.

The use of qualitative indicators does not set any restrictions on the types of information to include in the assessment and, thus, they can be used in a more exploratory manner than both the quantitative and semi-quantitative indicators. Gauthier (2005), for example, formulates in relation to the impact category 'quality, health and safety at work' that the product should meet the various quality or health and safety criteria in all stages of its life cycle. This very open formulation, however, should be seen in conjunction with the goal of her approach. Gauthier proposes a flexible assessment framework somewhat parallel to the semi-quantitative LCIA approach of the MECO matrix in ELCA (Wenzel et al. 1997) with the overall goal of highlighting potential problems in the product chain. Thereby, the need for a quantitative assessment becomes less essential.

Quantitative indicators are primarily used by Cañeque (2002), Barthel et al. (2005), Hunkeler (2006), Norris (2006), Schmidt et al. (2004), Weidema (2006), and Nazarkina and Le Bocq (2006), whereas Dreyer et al. (2006), Spillemaeckers et al. (2004) and Méthot (2005) make use of semi-quantitative indicators. Gauthier (2005) and Manhart and Griebshammer (2006) mainly use qualitative indicators as visible in Table 1 and 2.

The other distinction relates to whether indicators are designed to measure the phenomena directly, or indirectly or by proxy. Two examples will be given below.

According to Dreyer (2006), it is well known among companies which have experience with registration of working accidents, for example, that the registered number of accidents cannot always be correlated with the quality of work environment in the company. The problem of using the number of reported working accidents as an indicator is that it is strongly influenced by how well reporting of working accidents is managed. A low number of reported incidents may thus reflect both a very efficient management practice and a very poor management where incidents are simply not reported. For work environment as well as for other areas where use of reported impacts is questionable, Dreyer (2006) therefore introduces the idea of assessing the management effort rather than the reported impacts. The indicator measurement thereby becomes an assessment of the will and ability of the company to avoid negative impacts (hence of the risk that impacts will occur) and not an assessment of the reported impacts themselves. This aspect is not dealt with explicitly in other SLCA proposals; however, the indicators used in the approach presented by Spillemaeckers et al. (2004), to some extent include an assessment of both

reported incidents of social impacts and the quality of the management system.

Another and very different example of measurement by proxy is given by Weidema who suggests a method of reverse compilation from available data sources. Reverse compilation could be used in relation to child labour, for example: Regional or national statistics on child labour are very scarce but, assuming that the children are either in school or working during day hours, a rough proxy indicator measurement of the total extent of child labour in the region can be made on the basis of statistics on education and demography (Nazarkina and Le Bocq. 2006).

### 3 Inventory Analysis

The objective of the inventory is to collect relevant information, identified during the scope definition. However, the type of information to gather is a source of disagreement among the SLCA proposals.

Apart from the creation of common impact categories and indicators, one of the most challenging aspects regarding SLCA seems to be the data collection. In ELCA, generic data on the relevant input and output has been created for a large number of processes but, according to Dreyer et al. (2006) and Spillemaeckers et al. (2004), among others, several difficulties may arise using the same approach in SLCA. As previously mentioned, they see impacts as a result of the conduct of the company rather than because of the nature of the individual process. Accordingly, two companies producing exactly the same products (and possibly with the same environmental impacts as evaluated in an ELCA) can have completely different social impacts. Thus, they advocate that social impacts have to do with the behaviour of the company towards its stakeholders (as opposed to the industrial process in ELCA), making use of generic process data irrelevant or at best very difficult to apply. Dreyer et al. (2006) and Spillemaeckers et al. (2004) see the management of a company as a very local phenomenon, making the data collection a question of collecting site specific data as opposed to the generally accepted approach of using more generic process data in the ELCA. However, collecting site specific data from the whole product chain is obviously a very demanding task and, as discussed in the paragraph on the setting of system boundaries, several approaches have been taken to delimit the product chain in order to restrict the needs for data collection. Accordingly, Spillemaeckers et al. (2004) suggest using a screening based on literature, Internet and various databases in order to locate focus areas along the product chain, and thereby delimit the on-site data collection. Hereby, they are also advocated for the use of generic data, although only in situations where the probability of large negative social impacts are small.

Regarding the site specific data collection, few have described the process in detail. However, Spillemaeckers et al. (2004) give some overall guidelines on monitoring approaches.

Even though Weidema (2006), Schmidt et al. (2004), and Manhart and Grießhammer (2006) acknowledge that site specific data in general will lead to more accurate assess-

ments, they still argue that using generic data from statistical databases (national, regional and global) can give a rough estimate on several social impacts. Also Barthel et al. (2004) propose the use of generic data from country and industry specific databases.

A third approach in relation to data collection is presented by Norris (2006) and Hunkeler (2006). The basic idea behind these two approaches is to use only a single impact category as a basis for the social assessment with a link to some broadly accessible generic data used as an indicator. Taking Norris (2006) as an example, he estimates mortality and morbidity impacts based on the assessed product or service production's contribution to increased GDP. The estimation is based on a statistical correlation between GNP rise and the mean life expectancy, which shows a very high positive correlation for countries with small GNP and a much smaller positive correlation for high income countries. Norris emphasises that estimations will be on the average, and that local conditions are likely to distort the picture.

The administrative advantage of using generic data is indisputable, as the assessment can be performed as a desktop study, giving a faster and less expensive assessment approach. Following these observations, Norris' (2006) and Hunkeler's (2006) proposals of including only a single indicator, for which data is easily obtainable, seems tempting. However, the comprehensiveness of both approaches is questionable and thereby their usability as a decision support. As an example, Norris' approach would always point towards the conclusion that products should be produced in the poorest possible country. Furthermore, the question of whether the accuracy of generic data is acceptable remains: Acknowledging that social impacts emerge primarily from the conduct of the specific company, how well can estimations based on generic databases resemble the assumed high accuracy of the site-specific data collection? Here, it should be noted that generic data could be made national or even sector specific as required, for example by Hunkeler (2006), instead of striving towards regionally or globally applicable data as in the ELCA.

### 4 Impact Assessment

The impact assessment is the phase of the ELCA where the inventory information is translated into impacts. The phase contains the classification, characterisation, and normalisation and valuation of impacts.

#### 4.1 Classification

In ELCA, classification is normally performed by assigning inventory results to impact categories (ISO 14044). However, in the UNEP-SETAC Cross-cutting taskforce, a discussion has arisen concerning whether to follow the approach known from ELCA or to classify according to the impacted stakeholders (Grießhammer et al. 2006). For both classification approaches it is crucial to be as complete as possible, keeping in mind the goal of the study, as excluded stakeholders or impact categories will not give weight to the final results. It should be noted that the two approaches are not mutually incompatible.

For classification according to stakeholder groups the UNEP-SETAC taskforce on SLCA has agreed on a minimal list of stakeholders, including: Workforce (workers/employees); local community; consumers (related only to the use stage); and society (national and/or global) (Grießhammer et al. 2006). Schmidt et al. (2004) also propose the above mentioned, but furthermore includes business partners and future generations.

As discussed earlier and illustrated in Table 1 and 2, there is not an agreed list of impact categories, neither for midpoint approaches, nor for endpoint approaches.

#### 4.2 Characterisation

The purpose of characterisation in ELCA, according to ISO 14044 (2006), is to aggregate the inventory results within the same impact category. This involves conversion of inventory data to a common metric.

As mentioned earlier, Weidema (2006) uses endpoint indicators, implying that he models inventory data to endpoint through impact pathways, based on the general idea to calculate all impacts as a reduction in the average well-being, denoted Quality Adjusted Life Years (QALYs). Each indicator has a severity, or impact factor, and an average duration. By summing the multiplications of incidence, severity and duration of each indicator, the total reduction in well-being can be calculated and expressed in years.

Two other approaches are presented by Barthel et al. (2005) and Schmidt et al. (2004). Barthel has three impact categories comprising 16 indicators. The indicators in each impact category have the same unit (e.g. seconds/functional unit) allowing for a simple summation of indicator scores resulting in a total measure for each impact category. Hereby, it is implicitly stated that the impact factor of each indicator is 1.

The approach of Schmidt et al. (2004) builds on the same principles, although a more detailed description is still under development.

Spillemaeckers et al. (2004) consider several of the impact categories as being complex phenomena, implying that up to eight indicators are needed to reasonably express its qualities. Each indicator is generally given the same impact factor, yet some are graduated in importance by classifying their compliance as either mandatory, in order to get the label, or voluntary. A very similar approach is taken by Dreyer (2006), however, whether or not Dreyer performs a characterisation is a matter of definition. Dreyer's indicators are based on many 'measures', i.e. questions to which the company should comply to get a good score. These measures could equally well be defined as indicators, implying that a characterisation is made.

Hunkeler's (2006) approach to characterisation is a bit different from other SLCA approaches. Hunkeler relates one indicator, the number of working hours along the production chain, to several impact categories, by assuming that the salary earned from the working hours is spent on improving the four impact categories: housing, health care, education and necessities (stressing that more impact cat-

egories should be added). Hunkeler's categorisation factors are estimated from the means of the average national costs of the commodities mentioned, expressed in working hours. By applying these characterisation factors to the working hours, a product's aggregated contribution towards obtaining these commodities can be calculated. The repartition of working hours into impact categories may be chosen according to a model of society. For example, an egalitarian society would give the same importance and then the same factor to every impact category.

Except for the approach presented by Weidema (2006) and Norris (2006), the whole concept of characterisation becomes somewhat different in SLCA than in ELCA, partly reflecting that the inventory analysis of many approaches collects information about impacts or behaviour predisposing impacts rather than on the kind of fundamental behaviour which would parallel the physical flows which are inventoried in ELCA. To give an example in ELCA, a CFC11 emission does not only contribute to the impact category ozone depletion, but also to global warming. In SLCA, a quantification of an indicator representing child labour impacts would not be relevant as a measure of discrimination impact or other social impacts. There is presently no consensus regarding these cause-effect relationships, and the characterisation approaches seem more oriented towards simplification of inventory results than towards a characterisation in line with the ELCA methodology.

#### 4.3 Normalisation and valuation

Very little work has been done on these elements of the SLCA. Grießhammer et al. (2006), Schmidt et al. (2004) and Weidema (2006) discuss the issue of normalisation, and Schmidt et al. (2004) also gives a discussion on valuation. The general trend is that normalisation and valuation in SLCA are suggested to be performed like in ELCA.

### 5 Conclusions

The review has given an overview of the present development of SLCA by presenting the existing approaches to SLCA and discussing how they address the methodological aspects in the ISO standardised ELCA framework.

The review found a multitude of different approaches with regards to nearly all steps in the SLCA methodology, reflecting that this is a very new and immature field of LCA.

We are still in a situation where a number of fundamental issues have not been agreed on and resolved. One fundamental issue seems to be which impact categories to include in the assessment and how to measure these. Some degree of consensus regarding this point seems paramount if the SLCA is to gain any weight as a decision support tool.

One problem in this regard is that the perception of social impacts is very variable. This point can be illustrated by comparing the midpoint-based approaches and, for example, the approach presented by Norris (2006). In the midpoint-based approaches, it was illustrated that the impact



categories included are closely related to the direct impact on workers and society. The very different approach presented by Norris (2006), on the other hand, showed how social impacts can also be assessed from a much more macroeconomic perspective. Finally, as pointed out by Nazarkina and Le Bocq (2006), indicators are generally defined at the organisational level and not the individual. The area of social impacts is thus very wide. If the SLCA is to give an adequate assessment of the social area, this width must either be accounted for, or some agreement upon the most important impacts to include in the SLCA must be reached.

Another problem is that the question of how to measure the social impacts is equally an area for disagreement. Barthel et al. (2005), for example, use direct quantitative measurements, whereas Dreyer (2006) advocates the need for proxy measurements using scorecards for semi-quantitative measurements.

The degree of complexity needed for measuring these social impacts is another fundamental issue. Some approaches advocate a detailed and site specific investigation, whereas others claim that statistical sources suffice. This divergence of view again is linked to the other very important discussion of data collection: Is generic data sufficiently accurate for the assessment or must site specific investigations be employed? From a pragmatic viewpoint, a minimum criterion for the quality of the input data must be that the value of the assessment as decision support should be better than no assessment at all. If this minimum can only be reached by using site specific data, the burden of assessing even a relatively simple product can become immense and easily lead to the need for drastically narrowing the boundaries of the assessment.

In this context, it is also important to remember that the quality of site specific data is very dependent on the auditing approach and therefore not necessarily of high accuracy, and that generic data might be designed to take into account the location, sector, size and maybe ownership of a company and thereby in some cases give a reasonable impression of the social impacts that can be expected from the company performing the assessed process.

The application-dependency of the methodology seems important to address here. Differences in approaches may be explained by differences in their intended use. Thus, when addressing width, depth, and information needs in the SLCA, it is important to remember that these must be balanced according to the relevance for its users.

To sum up, it is visible that SLCA is in the stage of development where different approaches emerge, hypotheses are tested and discussed (e.g. in the UNEP-SETAC task force on Social impacts in LCA). This stage comes before the stage of consensus creation and harmonisation, and this is visible in the diversity of the approaches included in the review.

**Acknowledgements** We would like to thank Pierre Mazeau from EDF, France, for stimulating discussions on social indicators, Catherine Benoît and Jean-Pierre Revéret from CIRAI, Canada, and Louise Dreyer from Hartmann, Denmark, for helpful comments.

## References

- Barthel L, Wolf MA, Eyerer P (2005): Methodology of Life Cycle Sustainability for Sustainability Assessments. Presentation on the 11th Annual International Sustainable Development Research Conference (AISDR), 6th–8th of June 2005, Helsinki, Finland
- Cañeque FC (2002): Evaluación de la situación laboral de empresas: El Análisis del Ciclo Vida como herramienta para el Desarrollo Sostenible. Departamento de Economía i Organización de Empresas, Universitat de Barcelona, Barcelona, Spain
- Dreyer L, Hauschild M, Schierbeck J (2006): A Framework for Social Life Cycle Impact Assessment. *Int J LCA* 11 (2) 88–97
- Dreyer L (2006): Interpretation of the Fundamental ILO Conventions into Business Context – Background for development of indicators for Social LCA. Department of Manufacturing Engineering and Management, Technical University of Denmark, Lyngby, Denmark
- Earthster (2007): <www.earthster.org>
- European Commission (2001): Promoting a European framework for corporate social responsibility – Green paper, Luxembourg : Office for Official Publications of the European Communities
- Flysjö A (2006): Indicators as a Complement to Life Cycle Assessment – A Case Study of Salmon. Presentation held 17<sup>th</sup> of June 2006 in Lausanne
- Gauthier C (2005): Measuring Corporate Social and Environmental Performance: The Extended Life-Cycle Assessment. *J Bus Ethics* 59 (1–2) 199–206
- Grießhammer R, Benoît C, Dreyer LC, Flysjö A, Manhart A, Mazijn B, Méthot A, Weidema BP (2006): Feasibility Study: Integration of social aspects into LCA. Discussion paper from UNEP-SETAC Task Force Integration of Social Aspects in LCA meetings in Bologna (January 2005), Lille (May 2005) and Brussels (November 2005). Freiburg, Germany
- Global Reporting Initiative (2007): <www.grig3.org/guidelines.html>
- Hunkeler D (2006): Societal LCA Methodology and Case Study. *Int J LCA* 11 (6) 371–382
- ISO 14044:2006 (2006): Environmental management – Life cycle assessment – Requirements and guidelines. International Standard Organisation, Geneva, Switzerland
- Manhart A, Grießhammer R (2006): Social impacts of the production of notebook PCs – Contribution to the development of a Product Sustainability Assessment (PROSA). Öko-Institut e.V., Freiburg, Germany
- Méthot A (2005): FIDD: A green and socially responsible venture capital fund. Presentation on the Life Cycle Approaches for Green Investment – 26th LCA Swiss Discussion Forum, 2005, Lausanne, Switzerland
- Nazarkina L, Le Bocq A (2006): Social aspects of Sustainability assessment: Feasibility of Social Life Cycle Assessment (S-LCA). EDF 2006, Moret-sur-Loing, France
- Norris GR (2006): Social Impacts in Product Life Cycles - Towards Life Cycle Attribute Assessment. *Int J LCA* 11 (1) (Special Issue) 97–104
- Schmidt I, Meurer M, Saling P, Kicherer A, Reuter W, Gensch C (2004): SEEbalance – Managing Sustainability of Products and Processes with the Socio-Eco-Efficiency Analysis by BASF. *Greener Management International* (45) 79–94
- Spillemaeckers S, Vanhoutte G, Taverniers L, Lavrysen L, van Braeckel D, Mazijn B, Rivera JD (2004): Integrated Product Assessment – The Development of the Label 'Sustainable Development' for Products Ecological, Social and Economical Aspects of Integrated Product Policy. Belgian Science Policy, Belgium
- Udo de Haes AH, Finnveden G, Goedkoop M, Hauschild M, Hertwich EG, Hofstetter P, Jolliet O, Klöpffer W, Krewitt W, Lindeijer E, Müller-Wenk R, Olsen SI, Pennington DW, Potting J, Steen B (2002): Life-Cycle Impact Assessment: Striving towards Best Practice. Society of Environmental Toxicology and Chemistry (SETAC), Pensacola FL, USA
- UNEP (2005): UNEP/SETAC Life Cycle Initiative: Life Cycle Approaches: From analysis to practice
- Weidema BP (2006): The integration of Economic and Social Aspects in Life Cycle Impact Assessment. *Int J LCA* 11 (1) (Special Issue) 89–96
- Weidema BP (2005): ISO 14044 also Applies to Social LCA. *Int J LCA* 10 (6) 381–381
- Wenzel H, Hauschild M, Alting L (1997): Environmental assessment of products. Vol. 1 – Methodology, tools and case studies in product development. First edition. Chapman & Hall, United Kingdom, Kluwer Academic Publishers, Hingham, MA, USA

Received: June 14th, 2007  
Accepted: November 5th, 2007  
OnlineFirst: December 7th, 2007





## **9 Appendix 3: Relevance and Feasibility of Social Life Cycle Assessment from a Company Perspective**

Jørgensen A, Hauschild M, Jørgensen MS, Wangel A (2009a): Relevance and Feasibility of Social Life Cycle Assessment from a Company Perspective. *International Journal of Life Cycle Assessment* 14 (3) 204-214

# Relevance and feasibility of social life cycle assessment from a company perspective

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Received: 23 July 2008 / Accepted: 4 March 2009  
© Springer-Verlag 2009

## Abstract

*Background, aim, and scope* Methodology development should reflect demands from the intended users: what are the needs of the user group and what is feasible in terms of requirements involving data and work? Mapping these questions of relevance and feasibility is thus a way to facilitate a higher degree of relevance of the developed methodology. For the emerging area of social life cycle assessment (SLCA), several different potential user groups may be identified. This article addresses the issues of relevance and feasibility of SLCA from a company perspective through a series of interviews among potential company users.

*Methods and materials* The empirical basis for the survey is a series of eight semi-structured interviews with larger Danish companies, all of which potentially have the capacity and will to use comprehensive social assessment methodologies. SLCA is not yet a well-defined methodology, but still it is possible to outline several potential applications of SLCA and the tasks a company must be able to perform in order to make use of these applications. The interviews focus on the companies' interest in these potential applications and their ability and willingness to undertake the required work.

*Results* Based on these interviews, three hypotheses are developed relating to these companies' potential use of SLCA, viz.: (1) needs which may be supported by SLCA

relate to three different applications, being comparative assertions, use stage assessments, and weighting of social impacts; (2) assessing the full life cycle of a product or service is rarely possible for the companies; and (3) companies see their social responsibility in the product chain as broader than dictated by the product perspective of SLCA. Trends for these three hypotheses developed on the basis of the opinions of the interviewees. Also, factors influencing the generalization of the results to cover other industries are analyzed.

*Discussion* Full comparative assertions as known from environmental life cycle assessment (LCA) may be difficult in a company context due to several difficulties in assessing the full life cycle. Furthermore, the comparative assertion may potentially be hampered by differences in how companies typically allocate responsibility along the product chain and how it is done in SLCA, creating a boundary setting issue. These problems do, only in a limited degree, apply for both the use stage assessment and the tool for weighting social issues.

*Conclusion* Despite these difficulties, it is concluded that all three applications of SLCA may be possible for the interviewed companies, but it seems the tendency is to demand assessment tools with very limited life cycle perspective, which to some extent deviate from the original thought behind the LCA tools as being holistic decision aid tools.

*Perspectives* It is advocated that there is a need to focus more on questions regarding the relevance and feasibility of SLCA from several different perspectives to direct the future methodology development.

**Keywords** Application · Business · Comparative assertion · Company perspective · Feasibility study · Interviews · Product comparison · SLCA · Social LCA · Use stage assessment · Weighting

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Responsible editor: Walter Klöpffer

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## 1 Background, aim, and scope

A fundamental motivation behind every method development is its use. Several aspects may influence whether or not a method is used, but key issues are: what are the needs of the intended user group, and what is feasible in terms of requirements to data and work? The purpose of this article is to raise these questions of relevance and feasibility in relation to social life cycle assessment (SLCA) and give some tentative answers, supporting the fact that the methodology development efforts are in line with the actual user needs and possibilities.

As mentioned in Jørgensen et al. (2008), methodologically different SLCA approaches are being developed for different user groups and applications. Different user groups may have different needs and possibilities and it is therefore possible to imagine several different types of uses that potentially require different methods. This article focuses on the companies as a potential large user group.

SLCA is a method currently under development<sup>1</sup> and will probably be so for many years to come. When analyzing the above questions, it is therefore also considered relevant to encompass trends that could influence the interest for using SLCA.

## 2 Experiences from previous studies

Even though there has been an increased activity on the development of SLCA in recent years, very little can be found in literature addressing the relevance and feasibility of SLCA in a company context. Several SLCA approaches address the company context, such as Schmidt et al. (2004), Dreyer et al. (2006), Méthot (2005), the Earthster initiative ([www.earthster.org](http://www.earthster.org)), and to some extent the third-party-labeling initiative by Spillemaeckers et al. (2004). Also, the laptop study performed by Manhart and Grießhammer (2006) should be mentioned here, even though their assessment approach is not directed specifically for companies.

In all studies, reflections on the use aspect are very limited. In relation to the feasibility of performing an SLCA, Schmidt et al. (2004) conclude from their use of an

SLCA including the full life cycle that data availability was a major obstacle in performing the assessment. Also, Manhart and Grießhammer (2006) mention in their SLCA laptop case study that data availability is a barrier for carrying out the analysis.

In relation to the relevance of SLCA in a company context, several different purposes of SLCA are proposed; Dreyer et al. (2006) and Manhart and Grießhammer (2006) propose an SLCA approach with the purpose of identifying improvement potentials in the product or service life cycle; Schmidt et al. (2004) propose a tool for comparing the social impacts of two comparable products or services; Spillemaeckers et al. (2004) develop a social labeling scheme including mainly the upstream part of the life cycle; and Méthot (2005) develops a life-cycle-oriented social responsibility investment tool. However, articles or reports on the extent to which these tools are adopted or demanded by companies in general are, to the authors' knowledge, nonexistent.

It therefore seems fair to state that knowledge about the user aspect of SLCA in a company context is very limited. Data availability may be an issue but, obviously, if SLCA proves to be sufficiently attractive, this barrier may be overcome. Also, we know that some tools have been developed (Schmidt et al. 2004; Dreyer et al. 2006; Méthot 2005; the Earthster initiative ([www.earthster.org](http://www.earthster.org))), but we know nothing about their general relevance for companies.

## 3 Research approach

Since the user aspect of SLCA is a nearly untouched area, it was considered appropriate to follow an inductive approach, where empirical data are used as the basis for theory development. The method of inquiry should therefore be explorative and flexible allowing for the development and testing of hypotheses. In this manner, the method of inquiry should have a clear iterative element, allowing for the continual testing of emerging hypotheses that evolved during the study. Furthermore, the study should be directed towards analyzing both already performed actions but also attitudes towards potential future actions.

In order to allow this "continual dialog" within the area of study and investigate activities which have already occurred or may potentially occur in the future, the explorative semi-structured interview was found to be suitable (Hakim 1987; Kvale 2004).

To reduce bias in the data analysis and writing process, the article has been revised and approved by the interviewees after conclusions were drawn. During the review process, nuances have been added to the conclusions, although not to an extent which called for a second revision by the interviewees.

<sup>1</sup> For other papers on social aspects in LCA, see Kloepffer and Udo de Haes (2008), Jørgensen et al (2008), Pelletier et al. (2007), Dreyer et al. (2006), Hayashi et al. (2006), Hunkeler (2006), Labuschagne and Brent (2006), Norris (2006), Weidema (2006), Gauthier (2005), Hunkeler and Rebitzer (2005), Christensen and Olsen (2004), Schmidt et al. (2004), Klopffer (2003), Sharma (2000). The reader may also refer to the following reports, conference proceedings, and web pages: Earthster ([www.earthster.org](http://www.earthster.org)), Flysjö (2006), Grießhammer et al. (2006), Manhart and Grießhammer (2006), Nazarkina and Le Bocq (2006), Barthel et al. (2005), Méthot (2005), Spillemaeckers et al. (2004).

**Table 1** Interviewed companies

Business	Size (employees)	Main customers	Market	Main activity
Health care	5–10,000	Business	Global	Manufacturing
Health care	20–40,000	Consumers	Global	Manufacturing
Health care	5–10,000	Consumers	Global	Manufacturing
Mechanical components	20–40,000	Business	Global	Manufacturing
Mechanical components	10–20,000	Business	Global	Manufacturing
Textiles and furniture	2–5,000	Consumers	European	Import
Biotech	2–5,000	Business	Global	Manufacturing
Biotech/food products	5–10,000	Business	Global	Manufacturing

### 3.1 Choosing the interviewees

The goal of the interviews was to establish knowledge about potential users, who therefore had to be located. Some assumptions about what characterizes a potential user had to be made, which will be discussed below.

SLCA will easily be a time-consuming and expertise-demanding method to apply. It was therefore assumed, prior to the interviews, that SLCA is not a method that will be used by all companies but rather by companies with some degree of CSR<sup>2</sup> involvement. Thus, it was assumed that the most likely user would be found among companies with ambitious CSR profiles. As an indicator of CSR involvement, participation in initiatives like Global Compact (UN 2007), Dow Jones sustainability index (DJSI 2007), or the like was used.

Furthermore, according to a large survey among small medium enterprises in Denmark (Copenhagen Center 2006), there is a very clear and positive correlation between company size and the extent to which a company finds it possible to allocate time and resources for CSR activities. It was therefore assumed that the most probable user company should be of a certain size.

Partly to give an adequate assessment of the national situation and partly for practical reasons, only companies located in Denmark were interviewed. A potential downside of this geographical choice was that, due to the limited number of larger companies in Denmark that also have a high engagement in CSR, none of the potential companies identified had what can be denoted as a high international brand value.

In the Danish context, eight companies of a certain size and interest in CSR were found who were willing to engage in the interviews. Table 1 shows some basic characteristics of these eight companies.

<sup>2</sup> CSR is short for corporate social responsibility. It is not unambiguously defined, but Business for Social Responsibility has described CSR as the way in which a company operates towards its internal or external stakeholders in a manner that meets or exceeds the ethical, legal, commercial, and public expectations that society has of business (Dahlsrud 2008).

Since SLCA in a company context is about demonstrating ethical or social performance, SLCA can be seen as related to CSR activities. The interviewees were therefore all employed in the company's CSR department, which the interviewees in all cases headed (except in one case), as it was assumed that considerations regarding the relevance and feasibility should be found in this department. The respondents were thereby dealing with the everyday challenges of the company's CSR engagement. In a few cases, the respondents were also included in the company's top management.

### 3.2 Performing the interviews

As discussed in Jørgensen et al. (2008), SLCA can include very diverse elements and is therefore not a well-defined method. However, in order to begin to answer the questions of relevance and feasibility of SLCA, it is necessary to have a definition of what it is that should be relevant and feasible. A broad definition of SLCA is therefore outlined.

Taking SLCA to parallel environmental LCA (ELCA), it can potentially be used for two different overall purposes (Wenzel et al. 1997):

- To compare the social impacts of two comparable products or services (or compare a product or service against a standard)
- To identify hot spots or improvement potentials in the life cycle of the product or service

In order to fulfill these purposes, some characteristics of the SLCA methodology can be outlined:

- It is an assessment method that focuses on social aspects.
- It focuses on the impacts caused by products or services potentially defined by a functional unit.
- It applies some degree of a life cycle perspective, depending on the goal and scope of the assessment.

These purposes and characteristics of SLCA will be used as a definition and delimitation for SLCA. Thus, the relevance of using SLCA in a company context should be

related to the two overall purposes of SLCA written in the two upper items since these are the overall services that SLCA may provide for the user. The relevance of SLCA is thereby in this study defined and delimited by the demand for not-already-developed tools that may facilitate these two or relatable purposes. It is in this connection important to emphasize that there are already a number of tools relating to the assessment or monitoring of social issues which companies may apply (see AccountAbility (2004) for a review), implying that rival tools exist in some cases.

At the same time, in order to provide these services, the company must perform an assessment characterized by the three lower items. To what extent these characteristics can be met defines and delimits the feasibility. These items, defining the services and characteristics, thereby serve as a point of departure for the themes around which the interviews should evolve. As will be discussed below, during the line of interviews, some of these themes were abandoned and some were expanded or nuanced as the understanding of the situation, in which the companies had to maneuver, increased. As a result, the interviews were gradually streamlined towards a more structured approach in the final interviews, but it also implied that some interviewees had to be approached twice.

A description and motivation for the choice of the mentioned themes are given below. The themes were not addressed in any specific order during the interviews.

One interviewing theme addressed the companies' perception of "the social" in their CSR work. What kind of social impacts did the company find relevant to address and for what stakeholders? This aspect seemed relevant to address since there already is a preconception of how to define "the social" in the various SLCA approaches in terms of impact categories to include for what stakeholders (Jørgensen et al. 2008). If the companies presented a very different perspective on "the social" than the perspectives presented in the SLCA community, this could give rise to concern in relation to the companies' use of SLCA.

A second theme pursued during the interviews was the possibilities to obtain data for the actual life cycle of their products. Both from a "common sense perspective" and on the basis of existing experiences presented in "Section 2," obtaining these data seemed to be a possible barrier for the companies in using SLCA.

A third theme which was altered during the interviews concerned the aspect of quantification or "gradual scoring" of "social performance," which is considered in many SLCA approaches as opposed to a more "binary scoring." This theme was considered because it was hypothesized before the interviews that companies would consider many of the "serious" social impacts, such as the violation of International Labor Organization (ILO) or human rights conventions, as a question of whether or not these impacts

were occurring rather than to which degree they were occurring. If this was the case, the idea of quantifying results would be less relevant from a company perspective. What became apparent during the first interview was that the company tried to have "spotless" suppliers. This led to a discussion of whether it would be acceptable to have a supplier that were "spotless" in relation to what it supplied to the interviewed company but "not spotless" with regards to other productions (for other companies). This issue, which will be discussed more in depth in "Section 4.3," was considered more relevant to address in the following interviews since the idea of considering the whole supplier instead of only that part of the supplier supplying the interviewed company would be a large change from the environmental LCA methodology and potentially conflict with the possibility to set consistent boundaries for a product-related assessment, which SLCA is intended to be as indicated above. Seen in retrospect, addressing the relevance of quantified results still seems pertinent but was, however, not pursued any further in this study.

A fourth theme which was gradually nuanced throughout the interviews related to what uses of SLCA were found to be attractive by the companies. In the first interview, little weight was put on this theme since it was simply assumed that companies would be interested in the uses of SLCA. However, during this interview, it became evident that this assumption was unjustified, as the interviewees found the key functionalities of SLCA mentioned above, being the thorough hot-spot identification and product comparison, unattractive. In the later interviews, this theme was therefore further discussed both by asking how the companies presently performed social assessments, what social assessment tools they felt were missing, and how SLCA potentially could improve on this situation.

A fifth theme addressed the companies' motives for carrying out CSR activities since it was assumed that a categorization of the companies' interest in SLCA could be established on the basis of different motives for performing CSR activities. This hypothesis, however, was neglected as it seemed that most of the companies did not have a clear-cut reason for performing CSR activities. Rather, their motives were mixed and at times somewhat diffuse, making it difficult to pursue the initial purpose of this interviewing theme.

When performing the interviews, it was assumed that the information about how the company conducted or wanted to conduct its business in the CSR area was relatively insensitive, which was also confirmed by the interviewees. The questions could therefore be formed in a direct manner and answers taken at face value. Nevertheless, to facilitate a freer discussion among the interviewer and interviewees and to avoid motivating interviewee embellishment of their current or future CSR work, the interviews were reported anonymously.



The interviewees were instructed to answer as representatives for their companies in all interviews.

## 4 Results

On the basis of the themes raised in “Section 3.2,” three hypotheses emerged. These were:

1. SLCA may support several and very different assessment needs for the interviewed companies, but not all needs call for method development.
2. Assessing the full life cycle of a product or service is rarely possible for these companies.
3. The interviewed companies see their social responsibility in the product chain as broader than dictated by the product perspective of SLCA

Below, elaborations will be made on each of these hypotheses based on the results of the interviews.

### 4.1 Different social assessment needs in a company context

In order to address in what way SLCA could be applied in companies, it was discussed in what way they used or wanted to use assessment of social aspects in relation to the company’s activities. As a point of departure for this discussion, it was necessary to explore what was actually understood by social impacts. It turned out that the companies had an almost unanimous understanding of the term, comprising impacts on workers, society, and users, where the types of impacts they considered were based on the ILO and Human Rights conventions or other internationally recognized texts. Comparing the company understanding with the way that the “social” is normally understood in SLCA (Jørgensen et al. 2008), they seem to harmonize well.

Returning to the main question about what social assessment needs the companies had, several different needs were mentioned. Each of these will be shortly described below.

One way of using social assessments in the companies was in relation to making a rough screening, primarily of first-tier suppliers, in order to locate potential social impacts which were seen as important. Such assessment could potentially be supported by SLCA. It should be noted that the companies generally did not put so much emphasis on potentially negative impacts in the downstream chain (further manufacturing, use, and disposal of their products), which is why only the upstream part of the product chain is mentioned here. Seven of the companies either followed or to some extent expressed interest in screening mainly the first tier of supplier. However, six of the companies had in fact already developed more or less formalized methods for

making such screenings of suppliers. The one company which did not yet use any screening tool found it probable that they would use one in the future. One of the aforementioned six companies found their existing screening tools burdensome to use and expressed a need for a more resource-efficient tool than they already applied.

In this connection, it should be noted that none of the companies found the idea of a more thorough hot-spot or improvement potential identification in the life cycle attractive. It seemed that when companies made more thorough assessments in their products’ life cycles, for example, through social audits of the suppliers, the companies addressed eventual critical issues of each supplier before moving to the next supplier, instead of assessing all suppliers and then selecting which one to address first.

Another social assessment activity which the companies mentioned relates to codes of conduct (CoC)<sup>3</sup>. Often in a business-to-business relationship, a company is demanded by its business partners to comply with a CoC. This demand for compliance encompasses the in-house production and to some extent the company’s first tier of suppliers. Assessing impacts can be a first step towards compliance with the business partners’ CoC. Thus, demands from the business partners in some cases have to do with assessing social impacts in their in-house production and the upstream chain. Performing such chain-oriented social assessment could potentially be supported by an SLCA-like method. Six of the interviewed companies had experienced that business partners or customers made demands about compliance to a CoC. The interviewed companies themselves did in all cases demand compliance with their own CoC from their first-tier suppliers. None of the companies expressed a need for further method development in this area.

A third way of using social assessments in which four of the eight companies showed some degree of interest in using was in relation to comparing the “social profile” of their product with that of a competitor’s product, which could be a way for companies to use their CSR activities to increase their competitive strength. Not surprisingly, the interest for this tool seemed to depend on the extent to which the company assumed to be able to promote a product in comparison to a competitor and the assumed business value of this promotion. The service SLCA should provide would thus be a comparison of the social consequences of the life cycle of two products with comparable functional units. This would be a close analogy to the environmental product comparison that can be made

<sup>3</sup> A CoC is generally a specification of how the company and potentially its suppliers should act according to a list of social issues, among others.

using ELCA, e.g., in the form of Environmental Product Declarations. Since this would be a unique service of SLCA, none of the companies had other ways of performing such comparisons. This application of SLCA will be termed “product comparison” in the remaining parts of the article.

Fourthly, two health care companies emphasized a need for social assessment methods related solely to documenting the social impacts on society of the use stage of their product, which for the health care companies could be assumed to be positive. Presently, both companies lacked a methodological approach for performing such assessments. Since a use stage assessment is part of full life cycle assessment, it will potentially be supported by SLCA. This application of SLCA will be termed “use stage assessment.”

Finally, one company had experienced a dilemma where they had to choose between imposing different (negative) social impacts on their stakeholders and searched for tools that could guide them in these situations. Weighting may be performed in relation to, for example, the product comparison mentioned above and could therefore potentially be supported by SLCA. This application will be termed “weighting.”

To sum up, it seems that several different social assessment needs are expressed in a company context which could all potentially be supported by SLCA as it was defined in “Section 3.” Yet, as the interviewees pointed out, with regards to methods for checking for compliance with a CoC or for screening suppliers, the general opinion was that the companies had already themselves developed ad hoc tools which functioned satisfactorily, but streamlining of these was obviously still welcomed. Thus, it seems, according to these companies, that SLCA should support the product comparison, the use stage assessment (or potentially other life cycle stage(s) for other companies), or the weighting of different types of impact. The demand for these tools, however, was less widespread or pronounced among the interviewees. In relation to the product comparison tool, only four of eight showed a varying degree of interest in the tool and merely two and one, respectively, mentioned the latter tools.

It therefore seems, according to the interviewed companies, that the main attractive usages of a SLCA were directed towards an external use. For example, both the product comparison and the use stage assessment would be put to use in order to demonstrate to their stakeholders that their product had certain advantages on the social area.

#### 4.2 The life cycle perspective

A central aspect of SLCA is that it applies some degree of a life cycle perspective as defined in “Section 3.2.” When assessing social impacts in a life cycle perspective, it is important to remember that most social impacts in the life

cycle of a product or service are related to the management of the production processes or the use of the product and less to the nature of the processes or products themselves (Dreyer et al. 2006; Spillemaeckers et al. 2004)<sup>4</sup>. In order to know how something is produced, it must at least be known where it is produced and preferably also under which conditions, information which cannot be determined from knowledge of the product and a bill of materials and list of production processes. The availability of this information and, hence, the interviewee’s possibilities for getting knowledge about their product chains is central.

In this regard, the capacity to address the often numerous suppliers in the product chain was essential. Seven companies stated that they in general did not have the capacity to identify and assess more than the first tier of suppliers. Five companies added that they in a few cases also did consider a second tier of suppliers, and one company had even in one (very simple) case made a relatively rough on-site assessment of the whole upstream chain.

Another issue was that of barriers for the flow of information. Four companies mentioned that in several cases they simply did not have the possibility to address other than the first tier of suppliers because of the unwillingness of suppliers to hand over this information to the companies or because the goods were bought on open markets furnished by a large number of unidentified suppliers.

Finally, two companies mentioned they considered it “bad business practice” not to trust their first tier of supplier to check its own suppliers, impeding their possibility to get information about others than those in the first tier of suppliers.

As a general comment to the life cycle focus, several companies spoke of the “ripple effect,” which implies that instead of assessing and managing the whole (upstream) life cycle themselves, they saw their responsibility as ensuring an acceptable social performance where they had influence, being their in-house production and their first tier of suppliers. The company then simply passed the demands on by asking the suppliers in the first tier to check their own suppliers and pass the demand on further upstream. The company would thereby not address and/or assess the social performance beyond their first tier, not because they considered far upstream suppliers unimportant but because of the possibilities to get information and influence these remote upstream tiers.

<sup>4</sup> However, even though this has not been studied in detail, the extent to which this is the case may vary depending on type of impact. For example, impacts on work environment may tend to be more process-related as has also been discussed in ELCA (Hauschild et al. 1998).



### 4.3 The product perspective

As noted as a defining characteristic in “Section 3,” SLCA is focused on social impacts caused by the product or service that is needed in order to fulfill the defined functional unit. It is thus the social impacts, which through a clearly identifiable cause–effect relationship are created in the life cycle of product or service, that are of interest. The line between what is and what is not someone’s responsibility is drawn by these cause–effect relationships. However, when discussing this theme with the interviewees, an interviewee explained that companies should not see their responsibility as something which can be deduced from ethical laws or standards, like these cause–effect relationships. Rather, the company should focus on whether their actions create trust among their main stakeholders. If, for example, one of a company’s main customers shows interest in a certain aspect, the company should act accordingly even if this implies taking responsibility for aspects that the company has not caused. It therefore seems that there may be a difference between the allocation of responsibility done in SLCA and how a company’s stakeholders draw the lines of responsibility. Analyzing further how SLCA would divide responsibility, some clarifications are needed: as mentioned earlier, Dreyer et al. (2006) and Spillemaeckers et al. (2004) claim that social impacts are mainly connected to the conduct of the company. Still, the conduct of the company may vary, not only from production site to production site but also internally at a production site from production line to production line, as pointed out by several of the interviewed companies, for example due to different work processes at different production lines allowing for different working conditions. Acknowledging that, when a company buys a component from a supplier, only the impacts which may be associated with the component through a clear cause–effect relationship should be included in the assessment implies that only the impacts created along the specific production line should be considered (plus any overhead or general impacts that may exist at the production site). Thus, specific impacts connected to a production line whose products are not part of the assessed product should not be considered in SLCA, even though they may happen on the same production site. In order to address this rather complicated concept of allocation of responsibility, a hypothetical scenario was discussed: a supplier produces both component A and B, but only component A is used in the assessed product and hence included in the product system. There are some major social impacts connected to the production of component B but none to A. Would it be acceptable for the company to buy product A and ignore the production of B?

According to the principles about allocation of responsibility stated here, which according to the definition stated

in “Section 3.2” should apply to SLCA, the company should give a positive reply since no clear cause–effect relationship between the production of A and B exists (at least in this example). However, all interviewed companies replied negatively; none of the companies could ignore the production of B. One mentioned they would consider impacts associated with production of A as most important, but still they would not accept poor working conditions in the production of B. No companies did consider other production sites by the same owner but narrowed their focus to the actual site, mainly, it seemed, because of practical reasons. This leads to the third hypothesis which states that the interviewed companies see their social responsibility in the product chain as being broader, i.e., directed towards a company perspective rather than dictated by the product perspective of SLCA.

An explanation of two respondents mentioned in relation to this issue was that the idea of tracking the consequences to some extent has been broadened to consider the motives; it is not enough that the production line is well managed with regards to social impacts, the manager has to have “pure motives.” If, for example, good working conditions exist in one part of the production site, the manager does not show “pure motives” if all workers do not enjoy the same standard.

However, this focus on product site instead of product line did possibly only apply in relation to suppliers. When it came to customers, in this case consumers, two health care companies mentioned they had specific interest in the impacts of the product in the use stage, implying that there may be a shift from company focus in the upstream part of the life cycle to a product focus in the downstream part of the life cycle.

Also, it seemed that there may be a difference between allocation of responsibility depending on whether the assessment is used for risk management or marketing: The purpose of risk management is here understood as ensuring that the company complies with stakeholders’ preferences, whereas, in relation to marketing, the purpose is to demonstrate excellence; something well beyond compliance. To comply with the stakeholder preferences, the whole production site should comply as discussed above, whereas when it comes to demonstrating something above compliance, there are no stakeholder demands, and, thus, the product perspective may be applied if this may in some way promote the company’s products or services. Yet, this final issue was not sufficiently discussed during the interviews and therefore remains hypothetical.

### 4.4 Trends

SLCA is still in its infancy and its development will probably continue over many years. When discussing a

suitable SLCA design, it is therefore reasonable to consider potential future changes in the companies' positions towards the method and its implications. There are studies addressing trends in CSR (for example Haigh and Jones 2006); yet, no studies were found which describe trends related to the three hypotheses made above in "Section 4." An analysis of future trends was therefore based solely on the opinions of the interviewees.

It was generally assumed by the companies that there would be a stronger focus on CSR in the future than there is now.

However, none of the companies mentioned that they expected their social assessment needs to change in comparison to how they have been presented in "Section 4.1." In relation to the life cycle perspective, the general opinion was that future business partners would demand a higher degree of monitoring and control of first tier of suppliers than what is the case today. One respondent was of the opinion that business partners would also make demands for monitoring and control of second tier of suppliers and another believed that business partners would demand that the conduct of the companies in the whole upstream chain would become the responsibility of the company putting the product on the market. The health care companies also expected that they would have a more systematic assessment of their impacts in the use stage. The general picture in relation to the life cycle perspective was therefore a trend towards a slight increase in the focus on more remote tiers of suppliers and, for some companies, a trend towards considering social implications of their products in the use stage as well. Regarding the incongruence between SLCA and companies on the product perspective, no changes were believed to occur; yet, one company mentioned the focus would be even more on the overall behavior of the company and less on the direct consequences of the product than today.

#### 4.5 Generalizability of results

The basis for the article is the analysis of eight Danish companies, which from a global perspective must be considered a very homogeneous group. This makes it difficult to extrapolate the results obtained here to other contexts. To get reliable information about the usability of SLCA for companies in other contexts, more analyses are therefore needed. However, in the following, we will point to some key aspects about the context of this analysis which may impede or promote the generalizability of the results.

Addressing primarily the uses of SLCA found in this study, it should be noted that the applications of SLCA, as mentioned in "Section 4.1," are generally related to external product marketing (comparative assertion and use stage assessment) and only to a limited extent to an internal

management perspective. During the interviews, the companies' motivations for performing CSR activities were also addressed as mentioned in "Section 3.2." Here, it turned out that much of the reasoning for being responsible did not relate to seizing business opportunities. On the contrary, all companies mentioned that a primary reason was that they saw it as the "right way" of conducting their business. This may indicate that other companies with more focus on the opportunity part of conducting CSR may show more interest in the proposed SLCA-marketing-related tools than the interviewees.

As noted in "Section 3.1," in a few cases, the respondents were also included in the company's top management. Even though the respondents included in the top management were very much in line with the other interviews, it may be that managers working only at a more strategic top management level could have other visions for the CSR activities, e.g., with focus on other maybe more radical views, on the types of assessments that are needed. Yet, how this potential difference in perspective would manifest in assessment needs is unknown.

Regarding the issues concerning the life cycle perspective found in "Section 4.2," it should be noted that the interviewed companies are from a Danish perspective all strongly engaged in CSR, as mentioned in "Section 3.1." Furthermore, an analysis conducted by Gjølborg (2007) concludes that, in comparison to 19 Organization for Economic Cooperation and Development (OECD) countries (OECD, excluding East European countries, Turkey, Mexico, Korea, Luxembourg, Iceland, Italy, and New Zealand), Danish companies in general have a high ranking in relation to CSR performance. This indicates that the CSR performance of the interviewed companies from an international perspective must be considered to be very high. Assuming that this CSR engagement is related to capacity, the majority of companies in the OECD countries will have less capacity to engage in SLCA than the companies interviewed in this study. Thus, when the interviewed companies found the life cycle perspective to be demanding, most companies will probably support this view. However, it should be mentioned that none of the interviewed companies can be characterized as having a high international brand value. It is possible that more well-known international brands would be more interested in the full life cycle because risk management in relation to their reputation may be a more critical issue, as they are more often the target of exposures (Roberts 2003; Klein 2000). This potential interest in the whole life cycle may give these companies other possibilities for performing life-cycle-oriented assessments than found here.

Concerning the generalizability of the product perspective addressed in "Section 4.3," it is difficult to find any direct indications. However, when going through the

assessment and management tools for business relating to accounting and reporting CSR (see AccountAbility (2004) for an overview), it seems that the focus is on the conduct of the entire company and not only related to a single production line. This may support the findings in this study that companies in general focus on the entire company and that companies thereby see their social responsibility in the product chain as broader than a product perspective.

## 5 Discussion and conclusions

What are the company needs and what is feasible in terms of requirements to data and work? For the interviewed companies in this article, three potential attractive applications of SLCA can be found where method development is called for, viz.: a product comparison; use stage assessment (or potentially other part of the life cycle); and a weighting of social impacts. However, when comparing these potential uses of SLCA with the other hypotheses made in “Section 4,” some problems meet the eye. First of all, it was found that the interviewed companies had difficulties in obtaining information about suppliers or customers in remote parts of the upstream or downstream chain. The same conclusion was also reached in the case studies referred to in “Section 2.” This problem is emphasized by the need for site-specific data, as suggested above, making the data collection very time and resource consuming. In relation to a product comparison, this implies that a full product comparison including the complete life cycle may be out of reach for most, if not all, of the interviewed companies, and, as pointed out in “Section 4.5,” probably also for most other companies. This problem may to some extent be mitigated in the future if companies gain further insight in their own production chains, as suggested in “Section 4.4.” In relation to the use stage assessment, the availability of data seems a smaller barrier for its use as it only relates to one stage in the life cycle for one product, and, in relation to the demanded weighting tool, this issue is of no relevance, as it does not relate specifically to the life cycle.

Furthermore, the issue raised in “Section 4.3” about the product perspective may also be problematic in relation to product comparison. The reason is that by accepting the interviewed companies’ view on responsibility comprising the whole production site in an SLCA would easily create a boundary setting issue, as the assessment would include not only the directly influenced production lines but potentially also a series of other lines, to some degree randomly delimited by the geographical boundaries of the production site. The results of the assessment would thus be the consequences of the assessed product or service plus an additional random amount, which would hamper a clear comparison of products or services.

However, as was hypothesized in “Section 4.3,” if the product comparison is used for marketing, i.e., an external use, rather than risk management, i.e., an internal use, which will probably be the case as was concluded in “Section 4.1,” the product perspective may be usable for companies already complying with stakeholders’ demands. Yet, this point remains undocumented.

In relation to the use stage assessment, both companies demanding this tool specifically asked for a product scope. Also, it may be argued that it is only in relation to the product comparison that strict rules for the boundaries of the assessment are essential. Neither are considerations regarding the boundaries required in relation to the weighting of social impacts.

Thus, it seems, for the interviewed companies, that the product comparison is impeded by at least the availability of data and potentially the incongruence about allocation of responsibility in SLCA and among the company stakeholders. The first problem may be mitigated by increasing access to data, for example, through the establishment of databases as attempted in the Earthster initiative ([www.earthster.org](http://www.earthster.org)), using, e.g., sector-specific data as suggested by Schmidt et al. (2004) or significantly reducing the scope of the comparison to only one or a few life cycle stages. The second problem, should it turn out to be so, could question the general idea of performing product comparisons of social issues for the interviewed companies. However, as the study is inconclusive on this matter, the use of product comparisons by the interviewed companies cannot be dismissed, but it seems very likely to be performed with a limited scope, at least until the companies gain larger insight in their own product chains. Regarding the two other potential applications of SLCA, being the use stage assessment and the weighting, these scoping issues are of little or no importance. This analysis therefore points out that they could be potential areas of application for SLCA for the interviewed companies.

In summary, at least for now with a limited availability of data, it seems that the use of SLCA tools for the interviewed companies and, as indicated in “Section 4.5,” possibly for most companies will be restricted to applications with very limited or no life cycle perspective. Hence, it is debatable to what extent at least the interviewed companies in fact demand SLCA as a parallel to ELCA since, at least to these authors, a cornerstone of SLCA is the life cycle perspective, as noted in “Section 3.2.” By developing SLCA tools for applications without a full life cycle perspective, it runs the risk of becoming a tool for endorsing specific parts of the life cycle rather than for a holistic assessment method as normally associated with life cycle assessment methods.

However, here, it should be remembered that this analysis builds on a very limited number of companies

from a very limited geographical area and that companies in other contexts may have other possibilities or needs, as pointed out in “Section 4.5.” Thus, more than giving final results about the usability of SLCA in a company context, this article raises the question and points out that the usability of SLCA is not self-evident. When developing the SLCA methodology, it therefore seems very important to consider whether the relevance and feasibility expected by the developer is actually in accordance with the situation of the intended user group.

## 6 Perspectives

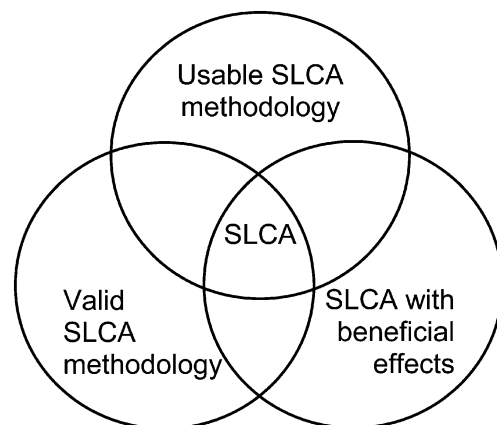
In the short history of SLCA, the main focus has been on methodology development and the performance of case studies. These case studies can highlight aspects of importance for how SLCA is to be developed, for example, through illustrating that a result can actually be reached through following a certain methodology and the practical implications of using a certain approach, for example, related to getting data, as was touched upon in “Section 2.” However, we advocate that the only criterion of success for the development of SLCA cannot be merely whether a result can be reached in a feasible manner. This article has focused on relevance together with feasibility in order to address one criterion of success for the development of SLCA, namely, the usability. Many questions are still to be answered with regards to this criterion, considering also the usability of SLCA from a nongovernmental organization or governmental organization perspective since they may also have specific needs and limitations which will affect their potential use of SLCA.

However, assuming that most scholars are engaged in the development of SLCA because of the expectation that SLCA will in some way or the other have a beneficial effect on the stakeholders in the life cycle of the assessed product, SLCA should not only be usable but also have a certain beneficial effect. Or, maybe more modestly, SLCA should as a minimum not inflict damage on the stakeholders in the life cycle of the assessed product or service. One reason why such damage could occur relates to the “cut-and-run” phenomena, denoting a situation where a company severs their contract with a supplier because of its low performance on social or environmental issues. A very real problem of this conduct may be the closing down of suppliers, setting the workers in even poorer situations than before (see, for example, CS Monitor (2006)). An SLCA focusing on the conduct of the suppliers and customers would in principle encourage a company using an SLCA to sever their connection with low-performing suppliers. SLCA could in this way, and in several others, create negative social impacts for the stakeholders it is in principle

made to defend. To increase the beneficial effect of SLCA, such potential consequences have to be investigated so that specific requirements for the methodological development can be proposed.

Addressing the potential uses of SLCA as mentioned in “Section 3,” the way in which the SLCA could have a beneficial effect is through enabling the producer to identify and potentially act on the main social impacts in the life cycle or through enabling, e.g., consumers, to choose the product with the best social impacts. This, however, implies that the result has to be valid, i.e., the assessment result has to represent the actual effect on the stakeholders of the life cycle of the assessed product. An invalid assessment, on the other hand, would potentially point decision makers towards the poorer product and thereby “cause” the continuation of these poorer conditions. Therefore, together with the “effect of SLCA” comes the “validity of SLCA” as a second and third criterion of success. Validity can obviously also be seen as an inevitable demand for an assessment method developed within a scientific milieu since one proposed purpose of science is to establish valid information. The demand for validity is by no means new in relation to SLCA. In most, if not all, of the proposals on SLCA, measures are taken to increase the validity. However, validity in some work on SLCA seems to be placed subordinate to concerns of feasibility. We propose a juxtaposition of not just usability and validity but of all three proposed criteria as illustrated in Fig. 1.

In relation to the continued research on SLCA, a significant difference between the criteria is that whereas the usability as mentioned above inevitably will be explored in the development of SLCA, this is not the case for the validity and effect of SLCA. For example, case studies would in many cases not capture these two aspects. We therefore find that research specifically within these two areas—the validity and effect of SLCA—should be a central activity in the SLCA development.



**Fig. 1** Proposed criteria of success for the development of SLCA



## References

- AccountAbility (2004) Strategic challenges for business—in the use of corporate responsibility codes, standards, and frameworks. Report prepared by AccountAbility for the WBCSD AccountAbility and Reporting Working Group Geneva, Switzerland
- Barthel L, Wolf MA, Eyerer P (2005) Methodology of life cycle sustainability for sustainability assessments. Presentation on the 11th Annual International Sustainable Development Research Conference (AISDR), 6th–8th of June 2005. Helsinki, Finland
- Christensen F, Olsen S (2004) The potential role of life cycle assessment in regulation of chemicals in the European Union. *Int J Life Cycle Assess* 9(5):327–332
- Copenhagen Centre (2006) Håndtering af sociale og miljømæssige krav i globale værdikæder—perspektiv for små og mellemstore virksomheder. The Copenhagen Centre for Corporate Responsibility. Copenhagen, Denmark
- CS Monitor (2006) Christian Science Monitor. <http://www.csmonitor.com/2006/1222/p01s03-wosc.html>
- Dahlsrud A (2008) How corporate social responsibility is defined: an analysis of 37 definitions. *Corp Soc Respon Environ Manage* 15(1):1–13
- DJSI (2007) Dow Jones Sustainability Index. <http://www.sustainability-indexes.com/>
- Dreyer L, Hauschild M, Schierbeck J (2006) A framework for social life cycle impact assessment (10 pp). *Int J Life Cycle Assess* 11(2):88–97
- Flysjö A (2006) Indicators as a complement to life cycle assessment—a case study of salmon. Presentation held 17th of June 2006 in Lausanne
- Gauthier C (2005) Measuring corporate social and environmental performance: the extended life-cycle assessment. *J Bus Ethics* 59(1–2):199–206
- Gjøølberg M (2007) The origin of corporate social responsibility: global forces or national legacies. Working paper. Centre for Development and the Environment (SUM), University of Oslo, Norway <http://www.compass.org/Gjolberg2007.pdf>
- Grießhammer R, Benoît C, Dreyer LC, Flysjö A, Manhart A, Mazijn B, Méthot A, Weidema BP (2006) Feasibility study: integration of social aspects into LCA. Discussion paper from UNEP-SETAC Task Force Integration of Social Aspects in LCA meetings in Bologna (January 2005), Lille (May 2005) and Brussels (November 2005). Freiburg, Germany
- Haigh M, Jones MT (2006) The drivers of corporate social responsibility: a critical review. *The Business Review*, Cambridge 5(2)
- Hakim C (1987) Research design – strategies and choices in the design of social research. Allen & Unwin, London
- Hauschild M, Wenzel H, Alting L (1998) Environmental assessment of products, vol. 2, Scientific background, 1st edn. Kluwer Academic, Hingham
- Hayashi K, Nakagawa A, Itsuno N, Inaba A (2006) Expanded damage function of stratospheric ozone depletion to cover major endpoints regarding life cycle impact assessment. *Int J Life Cycle Assess* 11(3):150–161
- Hunkeler D (2006) Societal LCA methodology and case study. *Int J Life Cycle Assess* 11(6):371–382
- Hunkeler D, Rebitzer G (2005) The future of life cycle assessment. *Int J Life Cycle Assess* 10(5):305–308
- Jørgensen A, Le Bocq A, Nazarkina L, Hauschild MZ (2008) Methodologies for social life cycle assessment. *Int J Life Cycle Assess* 13(2):96–103
- Klein N (2000) No logo. Flamingo. Harper Collins, London
- Klopffer W (2003) Life-cycle based methods for sustainable product development. *Int J Life Cycle Assess* 8(3):157–159
- Kloepffer W, Udo de Haes H (2008) Life cycle sustainability assessment of products (with comments by Helias A. Udo De Haes). *Int J Life Cycle Assess* 13(2):89–95
- Kvale S (2004) Interviews: an introduction to qualitative research interviewing. Sage, London
- Labuschagne C, Brent AC (2006) Social indicators for sustainable project and technology life cycle management in the process industry. *Int J Life Cycle Assess* 11(1):3–15
- Manhart A, Grießhammer R (2006) Social impacts of the production of notebook PCs—contribution to the development of a product sustainability assessment (PROSA). Öko-Institut e.V., Freiburg
- Méthot A (2005) FIDD: A green and socially responsible venture capital fund. Presentation on the Life Cycle Approaches for Green Investment—26th LCA Swiss Discussion Forum, 2005, Lausanne, Switzerland
- Nazarkina L, Le Bocq A (2006) Social aspects of sustainability assessment: feasibility of social life cycle assessment (S-LCA). EDF 2006, Moret-sur-Loing
- Norris GR (2006) Social impacts in product life cycles—towards life cycle attribute assessment. *Int J Life Cycle Assess* 11(1):97–104
- Pelletier N, Ayer N, Tyedmers P, Kruse S, Flysjö A, Robillard G, Ziegler F, Scholz AJ, Sonesson U (2007) Impact categories for life cycle assessment research of seafood production systems: review and prospectus. *Int J Life Cycle Assess* 12(6):414–421
- Roberts S (2003) Supply chain specific? Understanding the patchy success of ethical sourcing initiatives. *J Bus Ethics* 44(2–3):159–170
- Schmidt I, Meurer M, Saling P, Kicherer A, Reuter W, Gensch C (2004) SEEBalance—managing sustainability of products and processes with the socio-eco-efficiency analysis by BASF. *Green Manage In* 45:79–94
- Sharma VK (2000) Wastepaper in Mumbai (India) an approach for abridged life cycle assessment. *Int J Life Cycle Assess* 5(1):12–18
- Spillemaeckers S, Vanhoutte G, Taverniers L, Lavrysen L, van Braeckel D, Mazijn B, Rivera JD (2004) Integrated product assessment—the development of the label ‘Sustainable Development’ for products ecological, social and economical aspects of integrated product policy. Belgian Science Policy, Brussels
- UN (2007) United Nations global compact. <http://www.unglobalcompact.org/>
- Weidema BP (2006) The integration of economic and social aspects in life cycle impact assessment. *Int J Life Cycle Assess* 11(1):89–96, special issue
- Wenzel H, Hauschild M, Alting L (1997) Environmental assessment of products, vol. 1. Methodology, tools and case studies in product development, 1st edn. Kluwer Academic, Hingham

## **10 Appendix 4: Assessing the validity of impact pathways for child labour and well-being in Social Life Cycle Assessment**

Jørgensen A, Lai LCH, Hauschild M (2009b): Assessing the validity of impact pathways for child labour and well-being in Social Life Cycle Assessment. *International Journal of Life Cycle Assessment* 15 (1) 5-16

# Assessing the validity of impact pathways for child labour and well-being in social life cycle assessment

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Received: 10 March 2009 / Accepted: 26 August 2009  
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## Abstract

*Background, aim and scope* Assuming that the goal of social life cycle assessment (SLCA) is to assess damage and benefits on its ‘area of protection’ (AoP) as accurately as possible, it follows that the impact pathways, describing the cause effect relationship between indicator and the AoP, should have a consistent theoretical foundation so the inventory results can be associated with a predictable damage or benefit to the AoP. This article uses two concrete examples from the work on SLCA to analyse to what extent this is the case in current practice. One considers whether indicators included in SLCA approaches can validly assess impacts on the well-being of the stakeholder, whereas the other example addresses whether the ‘incidence of child labour’ is a valid measure for impacts on the AoPs.

*Materials and methods* The theoretical basis for the impact pathway between the relevant indicators and the AoPs is analysed drawing on research from relevant scientific fields.

*Results* The examples show a lack of valid impact pathways in both examples. The first example shows that depending on the definition of ‘well-being’, the assessment

of impacts on well-being of the stakeholder cannot be performed exclusively with the type of indicators which are presently used in SLCA approaches. The second example shows that the mere fact that a child is working tells little about how this may damage or benefit the AoPs, implying that the normally used indicator; ‘incidence of child labour’ lacks validity in relation to predicting damage or benefit on the AoPs of SLCA.

*Discussion* New indicators are proposed to mitigate the problem of invalid impact pathways. However, several problems arise relating to difficulties in getting data, the usability of the new indicators in management situations, and, in relation to example one, boundary setting issues.

*Conclusions* The article shows that it is possible to assess the validity of the impact pathways in SLCA. It thereby point to the possibility of utilising the same framework that underpins the environmental LCA in this regard. It also shows that in relation to both of the specific examples investigated, the validity of the impact pathways may be improved by adopting other indicators, which does, however, come with a considerable ‘price’.

*Recommendations and perspectives* It is argued that there is a need for analysing impact pathways of other impact categories often included in SLCA in order to establish indicators that better reflect actual damage or benefit to the AoPs.

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**Keywords** AoP · Area of protection · Child labour ·  
Impact pathways · Indicators · Objective indicators · SLCA ·  
Social LCA · Subjective indicators · Well-being

## 1 Background, aim and scope

The inclusion of social aspects in an LCA methodology (SLCA) is a relatively new development within the LCA

community.<sup>1</sup> SLCA is not a well-defined method (Jørgensen et al. 2008), but still it is possible to outline some overall common characteristics. Most, if not all, SLCA approaches are based on an idea of what it is they want to protect or enhance, either by explicitly stating an ‘area of protection’ (AoP),<sup>2</sup> or for example by stating that the assessment measures degrees of social sustainability. The idea behind SLCA is in other words most often that if the assessment shows a better score, the assessed product or system is better in relation to the AoP or e.g. more socially sustainable than a product or system which gets a lower score. In other words, SLCA is often based on utilitarian ethics, where utility is defined by the AoP, implying that every aspect included in the assessment should be seen in relation to its impacts on the AoP.

Whether or not the entities that we want to protect or enhance have been explicitly defined as such in the existing work on SLCA, they will in this article simply be termed AoP. By adopting an AoP (implicitly or explicitly), most SLCA approaches more or less explicitly assume a range of causal relationships or impact pathways, as they are called in the environmental LCA literature, connecting the indicators we use in the assessment and the AoP. These impact pathways may be avoided if the entities we want to protect or enhance through applying the SLCA are simply defined in terms of the indicators we include in the assessment. But in this case, we would face the problem of ensuring that these indicators are, in fact, relevant for the stakeholders in the life cycle of the assessed product or service. This approach and the problems related to ensuring relevance will, however, not be discussed here.

Another and very obvious characteristic of SLCA is that we want to assess the social impacts created as a consequence of the life cycle of a product or service as accurately as possible. A central issue in relation to assessing as accurately as possible the damage on or benefits to the AoP, there has to be a valid<sup>3</sup> impact

pathway<sup>4</sup> between the indicators that are used to assess the damage or benefits from the life cycle and the AoP. If there is no valid impact pathway, there is no way of telling whether and to what extent the indicators that we apply in SLCA actually represent damage on or benefits to the AoP. A valid impact pathway in other words ensures that a certain indicator score has a certain, predictable impact on the AoP. The importance of well-founded impact pathways has long been accepted in environmental LCA (ELCA), yet it seems that in SLCA literature until now, valid impact pathways have gained little attention. This lack may imply that there is no theoretically well-founded relationship between the indicators included in many SLCA studies and the AoPs (whether the latter are explicitly defined in the studies or not). In this article, we analyse two different examples of validity problems in the impact pathways in existing SLCA approaches. The two examples take opposite perspectives when addressing the issue: The first example starts in the AoP end of the impact pathway and analyses whether the types of indicators that are used in the various SLCA approaches are actually able to validly assess damages or benefits to the AoP. The second example starts in the opposite end of the impact pathway near the inventory information by examining a specific indicator, which is often applied in SLCA approaches, and analysing whether this indicator actually assesses damage on or benefit to the AoPs of SLCA. The assessment of the validity of these (often implicit) impact pathways in SLCA is substantiated drawing on empirical findings from relevant fields of research.

Each example is followed by a short discussion of how shortcomings in terms of valid impact pathways may potentially be mitigated. However, as will become clear, an increased validity comes at a price that may be substantial.

<sup>1</sup> For earlier work on social aspects in LCA, see Benoît and Mazijn (2009); Klöpffer and Udo de Haes (2008); Jørgensen et al. (2008), (2009); Dreyer et al. (2006); Hunkeler (2006); Labuschagne and Brent (2006); Norris (2006); Weidema (2006); Gauthier (2005); Hunkeler and Rebitzer (2005); Schmidt et al. (2004); Klöpffer (2003). The reader may also refer to following sources: Earthster (2008); Flysjö (2006); Grießhammer et al. (2006); Manhart and Grießhammer (2006); Nazarkina and Le Bocq (2006); Barthel et al. (2005); Méthot (2005); Spillemaeckers et al. (2004)

<sup>2</sup> AoP is a term originally defined in environmental LCA to represent the classes of environmental endpoints that society wants to protect (Udo de Haes et al. 1999)

<sup>3</sup> An assessment will in this article be defined as ‘valid’ if the assessment measures what we intend to measure. An assessment method is valid if it allows for valid assessments. The degree of validity in other words defines the correspondence between reality and the assessment result. Validity is not to be confused with ‘reliability’ which ‘merely’ relates to reproducibility or the degree to which the result will always be the same if the assessment method is applied on the same situation. An assessment method can thereby be highly reliable without being valid whereas the opposite is not possible (Carmines and Zeller 1979).

<sup>4</sup> A question which arises is how we can validly assess social impact pathways. For this to make sense, we have to make a series of assumptions about the social world. First of all, we have to assume that the social world is real and that it can be examined and communicated accurately. If not, it does not make sense to say that an assessment of the social world resembles accurately the reality of the social world. The social world is by other words in this SLCA framework assumed real, measurable, communicable and independent of our measurements.

It does not serve the purpose of this article to discuss these positions towards the nature of the social world in any depth but we will however mention that opposite viewpoints are widespread throughout academia implying that several research paradigms within the social sciences would contest these assumptions. See for example Burrell and Morgan (1979) for a discussion of different research paradigms within the social sciences.



## 2 What is it we want to protect? Example 1: the well-being of the stakeholder

What we want to protect in an SLCA is as mentioned above defined by the AoP. A short review of articles and reports on SLCA published until now shows that the AoP of SLCA has been explicitly discussed in Weidema (2006); Dreyer et al. (2006); Nazarkina and Le Bocq (2006), and Schmidt et al. (2004). Benoît and Mazijn (2009) also include a discussion of an AoP, which is however called a ‘social endpoint’, but the meaning remains the same. Dreyer et al. (2006) and Weidema (2006) state that their AoPs focus on what could be termed the intrinsic value of the well-being of humans (in a broad notion). Well-being is also mentioned as the AoP by Benoît and Mazijn (2009). Schmidt et al. (2004) focus on the preservation or enhancement of different types of ‘societal capitals’, an approach based on the World Bank’s ‘four capitals approach’, which include social, human, and produced/physical capital besides natural capital. This approach is conceptualised with reference to national wealth and denotes the maintenance and enhancement of wealth for the present and future generations (World Bank 1997; Berger-Schmitt and Noll 2000). The definition of AoP by Nazarkina and Le Bocq (2006) explicitly relates to both well-being and the societal capitals. Weidema (2006) and Benoît and Mazijn (2009) also mention both categories, which they find being related (if these societal capitals are set to equal social sustainability, which is often the case) as it is stated that the ultimate objective of sustainable development is to maximise the well-being of humans. The societal capitals (or social sustainability) can thereby according to these authors be seen as subordinate to the overall goal of well-being of humans. In the present SLCA literature, the AoPs are thus defined as relating to the well-being of the individuals as it is affected by the life cycle of the assessed product or service (individual AoP), and to the wealth of the society (societal AoP). Table 1 categorises the mentioned SLCA approaches according to the AoP they apply.

In the approaches dealing with the individual AoP the meaning of well-being is not addressed in great detail. Yet, well-being has in literature on the subject been understood in several different ways. For example Galloway (2006) (on the basis of Veenhoven (1988)), outlines four different kinds of ‘being well’:

It is very possible that there may be other acceptable definitions of well-being and that this elaboration therefore is not a full account of the potential meanings. However, if we on the basis of this elaboration of well-being turn to the definitions given by Dreyer et al. (2006) and Weidema (2006), it may be noted that these are probably not related to ‘being of worth to the world’ since they mention the

intrinsic value of well-being and not this more instrumental understanding. Also, since Dreyer et al. (2006) mention ‘dignity’ and Weidema (2006) mention ‘anxiety’, which both seem to relate to the ‘inner’ rather than the ‘outer qualities’, their definition of well-being thus seem at least to include ‘inner qualities’. Nazarkina and Le Bocq (2006) on the other hand explicitly dismiss the understanding of well-being as defined by the ‘inner qualities’. Benoît and Mazijn (2009) also includes a discussion of well-being but do not come up with a clear definition of the term. However, words like happiness, life satisfaction, and affection are mentioned as aspects of well-being indicating that the ‘inner qualities’ are also seen as part of the well-being construct.

If well-being in the approaches by Dreyer et al. (2006); Benoît and Mazijn (2009) and Weidema (2006) should be understood as characterised by, or including, the ‘inner qualities’ in Table 2, i.e. as a person’s subjective experience of his/her own life, we can probably pin down its meaning (or part of its meaning) as it has been done in related research fields as: “life satisfaction, pleasant and unpleasant affect” (Diener and Suh 1997).<sup>5</sup> Assuming now that this is the case, we can draw on the experiences with the assessment of (impacts on) this ‘type’ of well-being, which has a long tradition in several fields of research, such as the fields of psychology and disability research (e.g. Schalock 1996; Cummins 2005), health research (WHO 1995) and social indicators research (e.g. Sirgy et al. 2006).<sup>6</sup> Here, this type of well-being is often denoted subjective well-being (SWB), which is a term that will be adopted in the remaining part of this article.<sup>7</sup>

Within these fields of research in the assessment of SWB, a distinction is made between objective and subjective indicators (see for example Sirgy et al. 2006). Objective indicators are indicators that are designed to measure impacts which can, at least potentially, be measured without the involvement of the experiences of the impacted stakeholder, for example, wages and working hours etc. Subjective indicators, on the other hand, are indicators that focus on the experiences or feelings of the impacted stakeholder.

<sup>5</sup> Many different but reasonably related definitions of this construct can be found. See for example Galloway (2006) for an overview.

<sup>6</sup> See also Martel and Dupuis (2006); Galloway (2006); Diener and Biswas-Diener (2002); Diener et al. (2002); Schalock et al. (2002); Michalos (2001); Cummins (2000); Felce and Perry (1996); Carley (1981)

<sup>7</sup> The mentioned literature deals with several different and closely related constructs. SWB is in some cases mentioned together with the term (subjective) ‘quality of life’, which by some is seen as identical to SWB and by some is seen as a broader construct. This article will utilise experience gained on ‘quality of life’ research without making a distinction between the terms when they are used in reasonably similar ways.

**Table 1** Two types of AoP definitions applied in current SLCA studies

Individual AoP	Societal AoP
Dreyer et al. (2006) Weidema (2006)	Nazarkina and Le Bocq (2006); Schmidt et al. (2004)
Nazarkina and Le Bocq (2006)	
Benoît and Mazijn (2009)	

An individual AoP indicates that the SLCA's goal is to assess impacts on the well-being of the individual. The societal AoP indicate that the goal of the SLCA is to assess the wealth of society in a broad notion. Some scholars claim that these goals are highly interlinked

Going through the actual indicators presented in the various SLCA approaches, it shows that only objective indicators are included. Assuming now that we are in fact interested in assessing well-being as outlined above and not another kind of well-being as illustrated in Table 2, there has to be a valid impact pathway connecting SWB with objective indicators.

This aspect has been addressed empirically several times in the above-mentioned fields of research mentioned. Here it shows that poor correlations are repeatedly found between the objective indicators and SWB (Cummins 2000; Diener and Biswas-Diener 2002). This is not to say that there is no correlation at all. For example, money may enhance life satisfaction (an aspect of SWB) when it means avoiding acute poverty whereas increase in income in developed countries has been accompanied by little rise in life satisfaction. This conclusion, that the rise of objectively measurable goods below a certain 'threshold' affects general life satisfaction, whereas a further increase above the threshold will only yield marginal results, seems to some extent general (Cummins 2000). In line with this Cummins (2000) argues that SWB is held under 'homeostatic' control, so that only changes to and from very poor objective life conditions will have a significant and lasting impact on SWB, implying that within a considerable range of objective living conditions SWB will not be significantly affected. The idea of creating a simple impact pathway between objective indicators and SWB of the stakeholder therefore is only valid in a very limited range of situations. Objective indicators can therefore to a limited extent be applied in the assessment of SWB but subjective indicators are central in obtaining a more valid assessment. Subjective indicators have gradually been refined so that presently there are indicators for assessing various aspects of the SWB with a good test–retest reliability and high internal consistency (Sirgy et al. 2006), indicating that a sound scientific basis has been established for these indicators. There is thus no immediate scientific basis for dismissing this type of indicators in SLCA.

Thus, if well-being defined in the individual AoP should be understood as SWB, it seems that including subjective

indicators in the assessment would improve the validity. However, several problems can be identified relating to their introduction.

From a practical perspective one problem relates to the availability of data. The inclusion of subjective indicators necessitates an assessment of the experience of the actually impacted stakeholder. This implies that an assessment has to be conducted in a highly site-specific way with an assessment of, for example, the actual worker. As already argued by Dreyer et al. (2006) and Spillemaeckers et al. (2004) this is not new to SLCA since also an assessment using only objective indicators calls for a site specific assessment. However, the objective indicators concerned often relate to the overall management of the company (Dreyer et al. 2006), and may therefore be on the company level rather than on the individual level which is required for subjective indicators. Furthermore, in some cases statistical databases may exist containing sector- and country-specific information on objective indicators for, e.g. work accidents or child labour, which would to some extent allow for 'desktop studies', significantly reducing the workload of performing an SLCA. From a practical perspective, data collection is likely to be a considerable task in performing SLCA (Jørgensen et al. 2009) and the use of subjective indicators is likely to intensify this problem.

Another problem of using subjective indicators relates to the use of SLCA results in management. By creating an overview of social impacts in the life cycle of a product or service, SLCA can be used for identifying important social impacts. The assessment may thereby serve as a basis for decision makers in order to manage the most significant social impacts in the product chain first. However, considering that a manager or policy maker can mainly change objective life conditions, such as changing or regulating the salary, working conditions, etc. and that there is a very weak correlation between SWB and the objective life conditions, this implies that impacts on the SWB will be less manageable than the objective life

**Table 2** Four different kinds of 'being well'

	Outer qualities	Inner qualities
Life chances	Living in a good environment	Being able to cope with life
Life results	Being of worth for the world	Enjoying life

The 'outer qualities' indicate qualities in an individual's life which can more or less readily be observed and appreciated by others than the individual. Well-being may in this conceptualisation both relate to what we have in terms of readiness to meet life's challenges and to what we have achieved. 'Inner qualities' are more related to how the individual sees itself which may also be described both in terms of what the individual sees itself as having of resources and as what it has achieved

conditions. Subjective indicators would therefore be difficult to be fully utilised in a potential management situation.

A third problem relates to the boundary setting of the assessment. As defined in the introduction, SLCA is typically about assessing the consequences of a product or service. The consequence can be formulated as the change from the situation with to the situation without the product or service, this change being allocated to the product or service. When assessing a product or service it is therefore important that we can differentiate between impacts that occur as a consequence of the product or service and impacts that cannot be attributed to it. In more practical terms, if we consider impacts on the worker, which has been a main focus in existing SLCA approaches (Jørgensen et al. 2008), this consequence has been interpreted as the impacts on the worker when he or she is working. We are thus interested in the impacts created in the work life, whereas impacts related to the non-work life is of no interest for the assessment. In SLCA where only objective indicators are used, it is relatively easy to distinguish where the impact occurs. To take an example, impacts related to the physical working conditions is something that occurs in the work life, and impacts from this activity can thus in a relatively easy manner be attributed the production of the assessed product. When applying subjective indicators, this division between work and non-work becomes more difficult. Not surprisingly, studies show that how the non-work life is experienced tends to be correlated to the experience of the work (Staines 1980; Rain et al. 1991; Tait et al. 1989). To take an example, if a person is dissatisfied with his or her life conditions in general, this dissatisfaction can influence how this person experiences the work life, or vice versa. When applying the subjective indicators to the work life, the assessment will therefore very easily be affected by the non-work life. In other words, the inclusion of subjective indicators would easily involve a boundary setting problem, as the boundaries for what is included in the assessment in relation to the subjective indicators will be extremely difficult to narrow down to only including the impacts arising from the work life. It is possible that the non-work life experiences can somehow be controlled for; however, how this control should be performed is far from clear. Including subjective indicators in SLCA would therefore almost inevitably create some level of inaccuracy in the assessment.

Based on this analysis, it can be argued that if well-being in SLCA should be understood as SWB or even merely as including SWB as part of the construct, problems of validity will easily emerge whether or not subjective indicators are included in the assessment.

On the other hand, if well-being should be more understood in line with ‘living in a good environment’ or ‘being of good to the world’ which are both explicitly

related to qualities external to the individual and therefore by definition related to only objective indicators, this problem of the subjective would be eliminated.

Another way to ‘handle’ the problem of SWB in SLCA, as pointed out by Matthias Finkbeiner, who among others reviewed this article, could be to adopt the same strategy as taken in ELCA. In ELCA, it is often the case that various emissions may not necessarily cause actual impacts. This problem has been ‘solved’ by relating emissions to ‘potential impacts’ rather than ‘actual impacts’. The very same strategy goes in relation to SLCA, where we could measure changes in objective living conditions by using objective indicators and simply speak of these as ‘potential impacts’ to well-being (here understood as SWB) rather than ‘actual impacts’.

### 2.1 Summing up on example 1

It was shown that several approaches define an AoP of SLCA as well-being. If well-being is understood in its probably most common form as a person’s subjective experience of his/her own life, the inclusion of subjective indicators will improve the validity of its assessment, at least until a better understanding of how well-being is affected by the objective living conditions is reached. This inclusion of subjective indicators is, however, related to practical, managerial and boundary setting problems relating to the inclusion of subjective indicators. Yet, if well-being is defined differently, as relating merely the world external to the individual, as done by Nazarkina and Le Bocq (2006), this would eliminate the problem, but would probably also imply that the meaning of well-being would be different from the most common understanding of the term.

### 3 How do we define the indicators? Example 2: indicators on child labour

In the first example, we have discussed the validity of impact pathways from a specific definition of the AoP and discussed whether the types of indicators that are used in the various SLCA approaches are actually able to assess damages or benefits to this AoP. We will now in example 2 address the validity of impact pathways from the ‘other end’ by taking a specific indicator and analyse whether valid impact pathways exists between this indicator and the various AoPs.

Child labour is often included in SLCA approaches, and a number of different indicators used to represent this impact category have been identified. Table 3 gives an overview of SLCA approaches which include child labour and their choice of indicators to represent this type of impact.

As may be noted, there is a relatively broad agreement that it is the incidence of child labour that should be

**Table 3** Overview of how SLCA approaches include child labour

Included by	Indicator
Barthel et al. (2005)	Seconds of child labour or hazardous child labour per produced unit. The assessment thereby focuses on the incidence of child labour or hazardous child labour
Dreyer et al. (2006)	The potential occurrence of child labour in a company based on a risk assessment of the company's management system. The assessment thereby focuses on the incidence of child labour
Manhart and Griebhammer (2006)	Incidence of child labour
Nazarkina and Le Bocq (2006)	Incidence of child labour
Schmidt et al. (2004)	Incidence of child labour (?)
Spillemaeckers et al. (2004)	The incidence of child labour and whether working children under 15 can attend school and are not performing hazardous work

As the indicators are not always present in the various available material, question marks are used to indicate when there is uncertainty of how the indicator is formulated

assessed in SLCA. Yet, Spillemaeckers et al. (2004) and Barthel et al. (2005) also consider school attendance and/or the exposure to hazardous work. Still, the 'incidence of child labour' is the most frequently used indicator on child labour in SLCA, and it is therefore relevant to examine to what extent this indicator gives a predictable impact on the AoP. In the following, the AoP will be deliberated in terms of its associated endpoint impact categories in order to establish impact pathways from the incidence of child labour to the AoP.

### 3.1 Establishing a model for the AoP and endpoint categories

As mentioned in Section 2 two 'types' of AoPs can be identified; one focusing on the well-being of the individual (Dreyer et al 2006; Weidema 2006; Nazarkina and Le Bocq 2006) and one focusing on the societal wealth (Schmidt et al. 2004; Nazarkina and Le Bocq 2006). We will first concentrate the analysis on the AoPs focusing on the individual well-being. 'Societal AoPs' will be discussed further below.

Dreyer et al. (2006) further elaborate the 'individual AoP' as to live a healthy and naturally long life, to live a decent life and enjoy respect and social membership, and to have access to food, water, clothes, medical care, etc. Weidema (2006) also elaborates on the AoP by including a list of endpoint impact categories comprising life and longevity; health; autonomy; safety, security and tranquil-

lity; equal opportunities and participation and influence. Nazarkina and Le Bocq's (2006) list comprises improvement of objective living conditions, which subsumes a decent standard of living, and economic and social progress. They furthermore include reduction of disparities, inequalities and social exclusion, promotion of equal opportunities and finally, preservation of human capital, which subsumes education, occupational health and safety, security and social protection.

Looking at these definitions in more detail, there is a high degree of overlap. All definitions include aspects of health (and longevity) and equality. However, only Weidema (2006) and Dreyer et al. (2006) include 'social inclusion' through Weidema's 'participation and influence' and 'autonomy' and Dreyer et al.'s 'social membership'. Furthermore, Dreyer et al. (2006) and Nazarkina and Le Bocq (2006) to a larger extent emphasise 'standard of living' through the fulfilment of physical needs and improvement of objective living conditions, whereas Weidema (2006) emphasises 'safety, security and tranquillity'. Finally Nazarkina and Le Bocq (2006) also include 'human development' through the focus on the development of skills and education. Based on these three approaches, an inclusive list of endpoint impact categories could therefore be: Health and longevity; equality; social inclusion; standard of living; human development and safety, security and tranquillity. It should here be noted that the point of establishing this inclusive list is not to come up with a 'better' AoP. In fact, an AoP can easily become too broad, and thereby overlap other AoPs resulting in double counting. The purpose here is merely to establish an AoP as inclusive as possible, which is needed for the following discussion.

For the definitions of the AoP focusing on the development and productivity of society, both Nazarkina and Le Bocq (2006) and Schmidt et al. (2004) conclude on the basis of the World Bank's 'Four Capital Approach' that the AoP should include; 'social capital', subsuming social networks, associations and institutions tied by common norms and trustful relationships; human capital, subsuming people's productive capabilities based on skills, education and health and finally, produced/physical capital, subsuming the stocks of machinery, factories, buildings and infrastructure and thereby representing an economic dimension. As may be noted, there are in some cases an overlap between the societal and individual AoP, which is quite reasonable considering that what is good for human well-being is often (but not always) good for the societal development, and vice versa.

### 3.2 Establishing the child labour impact pathways

Applying the incidence of child labour as an indicator in SLCA inherently assumes that it affects the endpoint



categories mentioned above and thereby also the AoP. Furthermore, in order to assess the damage on the AoP, the relation between the incidence of child labour and damage on the AoP has to be predictable, implying that a certain indicator ‘score’ will always result in the same impact on the AoP.

The impact pathway from the incidence of child labour to the two AoPs is attempted to be established based on available research from this field in order to assess the predictability of the relation.

A review of the literature on child labour quickly reveals that this is a complex issue. Working children may experience a series of different impacts ranging from acute to long-term and being of both a physical and a psychological nature, which may affect both the children and society in different manners. Below, these impacts are systematised and their relation to child labour is discussed. The analysis is based on statistical correlations and the conclusions drawn will therefore be on the average.

### 3.2.1 Health risks

One type of documented impacts from child labour is impacts on the child’s health. Referring to Fig. 1, impacts on health relates directly to both the AoPs through either ‘health and longevity’ or ‘human capital’ endpoint impact categories. A causal relationship thus clearly exists between child labour and damage to the AoPs, but the nature of the health risks depends strongly on the type of work (Fassa et al. 2000) and, as previously discussed in the SLCA community, on the management of the company (Dreyer et al. 2006; Spillemaeckers et al. 2004). Impacts may be fatal and non-fatal, including all kinds of acute, sub-acute or chronic impacts (Forastieri 2002). Therefore, the fact that a child works does not say very much about the impacts on health that the child experiences, implying that the incidence of child labour will not always result in the same type of damage on the AoP (in this case, impacts on ‘health and longevity’ or ‘human capital’).

### 3.2.2 Impacts on schooling outcomes

Another relatively well-documented impact from child labour is its impact on schooling outcomes. Schooling outcomes are represented by the endpoint category ‘human development’ (in the individual AoP) or ‘human capital’ (in the societal AoP), thereby establishing an impact pathway from the incidence of child labour to both AoPs. Child labour’s influence on schooling outcomes is something that has been addressed in numerous studies (See Amin and Quayes (2006) for a review). From an overall point of view, the tendency is that work affects schooling outcomes negatively; however, child labour’s influence on schooling

outcomes varies according to the amount of time used on work. It is debatable whether there exists a ‘threshold’ for the daily working time under which child labour does not affect schooling outcomes (Ray and Lancaster 2005), however, the overall conclusion seems relatively unambiguous: If the child has few hours of work, there may be a limited effect on the schooling outcomes, whereas long hours may significantly reduce schooling outcomes. Assuming that this conclusion can be generalised to other contexts, this implies that the impacts of child labour on education is not simply a question of either-or but a question of degree, meaning that a distinction should be made according to the conditions of the employment. An indication on whether or not a child is working does not predict the impact this may have on ‘human development’ or ‘human capital’ and thereby the AoP.

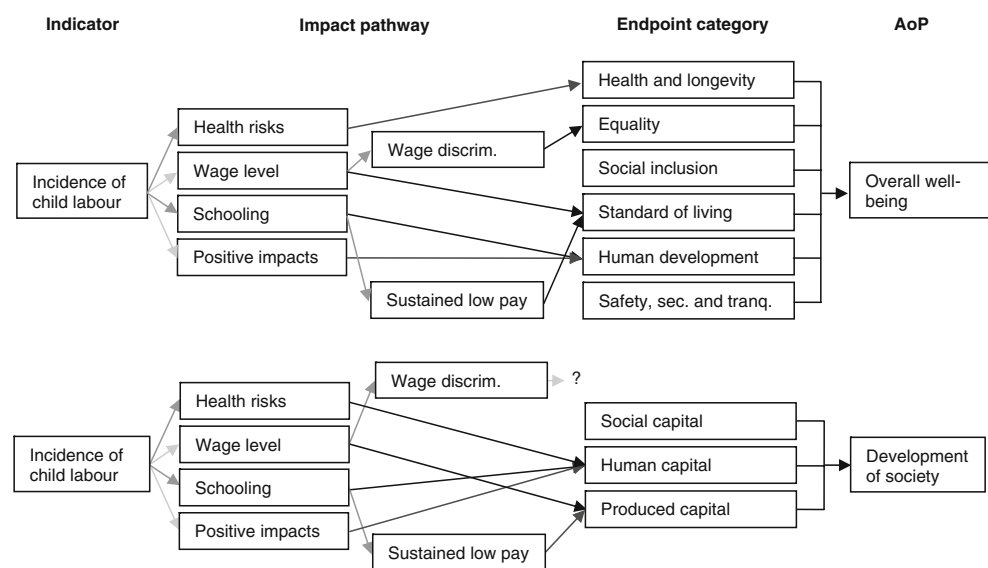
### 3.2.3 Wage level

The wage level may be understood in several ways. First of all, children are in some cases paid less than adults for the same amount of work (Levison et al. 1996). If discrimination is defined as putting group members at a disadvantage or treating them unfairly as a result of their group membership (Plous 2003) paying low wages to working children for equal work can be characterised as a sort of discrimination. In relation to the ‘individual AoP’ discrimination can be seen as the opposite of ‘equality’, and an impact pathway is thereby established. However, the extent to which children are paid less than adults for equal work varies with sector and country (ILO 2007). In some sectors and countries, there are no differences between child and adult pay whereas in other cases there are. Wage discrimination is therefore not a predictable result of child labour.

In relation to the ‘societal AoP’, wage discrimination or even discrimination is not included in the endpoint impact categories of the AoP, and it is therefore necessary to further model the impact pathway in order to find its potential relation to the AoP. However, no studies have been made documenting the potential impacts of wage discrimination among children, implying that the impact pathway from wage discrimination to the ‘societal AoP’ is uncertain, and thus also the impact pathway from child labour to the AoP in relation to this issue.<sup>8</sup>

<sup>8</sup> Several studies have been made addressing the consequences of discrimination (Williams (1999), Williams and Williams-Morris (2000)), yet, these studies relate to impacts of racial discrimination experienced in all parts of the everyday life and thus seem in many ways to differ from the impacts that may be suspected to affect children that are not paid as much as their elder colleagues, for example because wage discrimination only relates to the working life and because it only relates to a limited period of the person’s life. Thus simply assuming that the consequences of discrimination are also true for wage discrimination among children seems somewhat dubious.

**Fig. 1** The child labour impact pathway. The figure sums up the analyses from Section 3.2.1 to 3.2.4 and shows how a certain ‘amount’ of a given phenomenon, e.g. ‘incidence of child labour’ or ‘schooling outcomes’ affects next step in the impact pathway. A *black arrow* represents a relatively well-documented, predictable relationship; a *dark grey arrow* represents a relatively well-documented but unpredictable relationship; and a *light grey arrow* a potential, yet relatively undocumented and therefore potentially unpredictable relationship



Discrimination aside, studies also point to the possibility that working children later in life will have an increased risk of getting low pay (Ilahi et al. 2001). However, the studies propose that this may be an indirect result of reduced schooling outcomes, another effect of child labour as discussed above. If this is the case, then the aspect of ‘continual low pay’ should be accounted for in relation to schooling outcomes in order to avoid ‘double-counting’ child labour’s impact on schooling outcomes.

Finally, the child’s wage in cash or in kind, is often a necessary part of the family’s household (Basu and Van 1998) and has an impact on the family’s material well-being according to Fig. 1 which is directly related to the ‘individual AoP’. Also, seen isolated from its above effects, child wages will, as described above, increase the societal economic activity and will thus contribute to the produced or physical capital and thereby the ‘societal AoP’. However, as also mentioned above, wages from child labour vary implying that the incidence of child labour alone cannot predict the impact on the standard of living and produced/physical capital and thereby the AoP.

### 3.2.4 Positive impacts

Other effects on children from work, which in many respects are characterised as positive, may be the development of discipline, responsibility, self-confidence and independence; teaching children how to manage money and providing the child with working skills (Fassa et al. 2000; Edmonds and Pavcnik 2003). However, these impacts have not been thoroughly studied, and it is therefore difficult to state anything about how their effect on the AoP may vary according to the work activities.

Summing up, it seems that the incidence of child labour creates a series of both well-documented and of relatively

undocumented damages and benefits on the AoPs, but that these damages and benefits may vary significantly according to the character of the work. The findings have been summarised in Fig. 1 (please see figure text for explanations). Thus, using the incidence of child labour alone as a measure for impacts on the AoP entails high degrees of uncertainty. To reduce this uncertainty, the indicator for child labour could be moved from a registration of the mere incidence to the next or second step in the impact pathway (towards the right in Fig. 1), as the impacts on the AoP in both cases seem more predictable from indicators chosen at this level.

### 3.3 Problems related to substitution of the child labour indicators in SLCA

Even though the accuracy of SLCA may be improved by replacing the assessment of the incidence of child labour with indicators on ‘health risks’, ‘schooling outcomes’, ‘wage levels’, ‘positive impacts’ and ‘sustained low pay’ (and ‘wage discrimination’ in relation to the AoP focussing on the individual), this also entails several problems that need to be considered.

A practical problem relating to the proposed alternative indicators of child labour impacts is connected to their modelling. For example, it is not feasible to directly measure work’s impacts on schooling outcomes. Instead, a model has to be established enabling the development of an indicator. One suggestion could be to estimate the impact based on the number of hours the child works each day, which according to the literature reviewed in section 3.2.2 seems to be a good indication. However, since there are no studies on the exact quantitative relationship between hours worked per day and schooling outcomes, a semi-quantitative approach may be needed, for example using a

scale ranging from ‘no impacts on schooling outcomes’ to ‘severe impacts on schooling outcomes’ corresponding to ‘few hours of work’ to ‘full-time work’ as indicated in section 3.2.2. As with any model, it introduces some uncertainty, since even though there is a statistical correlation between working hours and schooling, there may be situations where working hours will have no influence on schooling outcomes, for example if the child lives too far away from a school rendering schooling impossible in any case. When relying on statistical analyses as referred above, there will therefore be situations where the assumed correlation between working hours and schooling will be incorrect. It could therefore be argued that even more detailed indicators than the ones proposed here are necessary, e.g. indicators also addressing distance to school, etc. To what extent such more nuanced indicators should be developed in relation to ‘schooling’ as well as for the other areas mentioned in this article, will not be discussed further here. However, if later scholars find this necessary, the approach of modelling impact pathways as used here will be applicable.

Direct measurement of ‘positive impacts’, such as the development of skills, would also be impossible to establish since many of these seem to be impacts created over time. Some assumptions about the type of work and the development of skills would therefore have to be established.

Another practical problem in the choice of indicators is the accessibility of data as data on child labour in general is scarce. The suggested introduction of new indicators are likely to intensify it, since they require a more detailed assessment of the type of child labour, for example hours of child labour, instead of the simpler overall indicator on the incidence of child labour. However, in some cases, some approximations seem possible. For example in relation to the health risks of child labour, studies show that the risk of these impacts happening is highly sector specific. Agriculture is ranked among the most hazardous industries for children due to the widespread use of dangerous machinery, strenuous labour and handling of chemicals (Fassa et al. 2000). The construction sector is also one of the most hazardous working environments with regard to the risk of accidents (ibid.). Industry has specific hazards linked to each production process depending on the tasks performed. Yet, health hazards tend not to arise from the production process but from the management of the production facilities, making it difficult to state anything about the general risk level (ibid.) but on an overall level manufacturing industries are found to have lower levels of self-reported accidents than agriculture (Edmonds and Pavcnik 2003). And finally, regarding the retail sector the main problems may be connected to long hours of work and changing schedules, often entailing work late at night and difficulties to combine work and school (Fassa et al. 2000),

but from a health perspective seemingly less hazardous. As these examples show, it may in some cases be possible to make usable approximations. But also here, it is likely that a semi-qualitative approach may have to be taken, as no data exist on the exact number and severity of child labour health impacts in the different sectors. Scores on health risks may therefore range from ‘high’ if the child is working in agriculture or construction, to ‘low’ if the child works in the retail sector.

Furthermore, changing the indicators of child labour also involves potential conflicts with the political reality of the context in which the SLCA is to be used and communicated. In the present debate, child labour is often considered by principle rather than by consequence. By focussing on the consequence on the AoP, SLCA diverges from this practice, since according to the proposed indicators above the incidence of child labour should only be included in the assessment if it is associated with health risks, effects on schooling outcomes, etc. Here, decision makers may be caught between two concerns: on one side the concern for the public opinion and on the other the concern for the actual consequence for, in this case, the impacted child. For example, looking at the use of SLCA in a company context, it is doubtful whether a company could communicate successfully to its stakeholders that child labour in some forms may be acceptable. Rather, a company would probably try to be in concordance with the general public opinion, which presently is that all sorts of child labour should be avoided in the product chain. The consequence of changing indicators as suggested here may thus be a reduction in relevance of SLCA for selected user groups, since results will address consequence and not principles.

Considering the high sensitivity of the social area in general, this dilemma between political reality on one side and science on the other creates a difficult milieu for performing assessments. On one hand, it has to relate to issues considered as important in the political debate, but on the other hand, the scientific and theoretical foundation for the assessment, in this case the empirically supported impact pathways, has to be acknowledged. In some cases, these two aims may be difficult to combine.

Here, it is important to note that the focus on a valid scientific base for the assessment is not just a scholastic exercise. On the contrary, if it is assumed that decisions to be based on the assessment results will have an actual consequence for the impacted stakeholders it is of outmost importance that the results of the assessment reflect the resulting damage on the impacted stakeholder. Wrong answers may even in some cases create negative impacts for the stakeholders. For example, by assessing the actual damage to the working child, the assessment may, through focusing on the child labour that creates negative impacts,

contribute to the abolishment of the worst forms of child labour, whereas an assessment focusing only on the incidence of child labour may through a ban of all kinds of child labour contribute to reducing the demand for child labour in the life cycle of the product. But since working children are generally forced to work due to poverty (Basu and Van 1998), a simple ban could force the affected children to take other, potentially worse, jobs.

If companies or other decision makers were more interested in child labour by principle than by consequence, it would not merely be a question of choosing indicators but rather AoPs, since in this case, ‘the incidence of child labour’ would become an AoP of itself, making this whole discussion of consequence irrelevant. The SLCA should in this case be based on a deontological ethics instead of a consequential ethics normally connected to the LCA methodologies.

As a final comment to the ‘incidence of child labour’ it should here be noted that we do not in this article in any way suggest that the ILO conventions on child labour are irrelevant. International conventions like these are in general important documents and also for SLCA when it comes to identifying important social concerns which should be covered by an SLCA. But in connection to this, it is important to remember that the purpose of the conventions and SLCA as presented here probably are different: Whereas the conventions are probably based on the ideal of establishing generally applicable recommendations for e.g. how work should be performed, the purpose of SLCA as presented here is to assess as valid as possible the consequence to the AoP of e.g. a specific type of work. A general recommendation in relation to child labour should be to abolish the ‘incidence of child labour’ as claimed by the ILO because it often carries with it severe impacts to the child, as documented above. But as was also documented above, the actual impacts vary depending on the work, and it is the actual impacts we are interested in assessing in an SLCA as presented here. So, even though we recognise the importance of the themes covered by the various international conventions, the conventions can not necessarily be used directly as indicators in an SLCA with the goal of assessing impacts on an AoP as accurately as possible.

### 3.4 Summing up on example 2

By analysing the often included indicator in SLCA, the ‘incidence of child labour’, we have shown that several well-documented impact pathways links it to the AoPs, but that the mere fact that a child works does not support an accurate prediction of the actual damage (or benefits) to the AoP.

The analysis shows that indicators further along the impact pathway should be considered. Yet, as was discussed in section 3.3 there are several other concerns than only validity, such as issues concerning feasibility of

indicator development, data availability and the political reality surrounding the SLCA.

Regarding the methodological and practical issues, the development of other child labour indicators which represent damage on the AoP in a more accurate manner seems manageable, but the increased demand for data that they entail may intensify the problem of getting data concerning child labour. Yet, approximations can to some extent mitigate this problem.

The choice of indicators will probably for many decision makers also depend on the focus of the audience and main stakeholders of the assessment. But if the goal of SLCA is to improve the social impacts that affect, in this case, the working children, an accurate assessment of impact on the AoP has to be a first priority, since what matters for the children is how they are impacted and not how this is perceived by the audience of the assessment.

## 4 Conclusion and perspectives

Digging deeper into the impact pathways underlying current approaches to SLCA has revealed that validity in several regards may be improved. The primary reason for this is clearly that since SLCA is a very young field of research the need for theoretically well-founded impact pathways is a research task which still has to be addressed in a consistent way. In line with this, we therefore point to the need for analysing the impact pathways for other impact categories currently addressed in SLCA, which may show the same problems as identified above (see Jørgensen et al. (2008) for examples of other impact categories), .

So, in spite of the problems identified for current SLCA approaches, there is a positive message from the work underlying this article: it demonstrates the possibility of analysing and assessing the validity of the impact pathways applied in SLCA, as it is done in ELCA. It may (still) be difficult to make a quantification of the indicator results in terms of impacts on the AoP as is to some extent possible in ELCA, but the qualitative analyses performed here take us the first step in identifying the (type of) indicators which can measure what we intent to measure in a more valid way. The analyses also showed that the increase in validity may come at a certain price in terms of loss of practicability, usability and even the introduction of new uncertainties. Future work may therefore show how compromises between validity, usability and practicability can be made. These analyses therefore does not give any final answers of how to conduct an SLCA but they illustrate how validation standards can be applied to SLCA enabling the development of a theoretically well-founded methodology, which will be necessary if SLCA is to develop as an acknowledged tool for decision support.



## References

- Amin S, Quayes S (2006) Market work and household work as deterrents to schooling in Bangladesh. *World Dev* 34(7):1271–1286
- Barthel L, Wolf MA, Eyerer P (2005) Methodology of life cycle sustainability for sustainability assessments. Presentation on the 11th Annual International Sustainable Development Research Conference (AISDR), 6th–8th of June 2005, Helsinki, Finland
- Basu K, Van PH (1998) The economics of child labor. *Am Econ Rev* 88(3):412–427
- Berger-Schmitt R, Noll H (2000) Conceptual framework and structure of a European system of social indicators', EU Reporting Working Paper No. 9, Mannheim, Germany. [http://www.gesis.org/fileadmin/upload/dienstleistung/daten/soz\\_indikatoren/eusi/paper9.pdf](http://www.gesis.org/fileadmin/upload/dienstleistung/daten/soz_indikatoren/eusi/paper9.pdf)
- Benoît C, Mazijn B (2009) Guidelines for social life cycle assessment of products. UNEP/SETAC Life Cycle Initiative, Druk in de weer, Belgium
- Burrell G, Morgan G (1979) Sociological paradigms and organisational analysis. Ashgate Publishing Limited, Aldershot, England
- Carley M (1981) Social measurement and social indicators: issues of policy and theory. G. Allen, Boston, USA
- Carmines EG, Zeller RA (1979) Reliability and validity assessment: reliability and validity assessments. Sage, Beverly Hills, USA
- Cummins RA (2000) Objective and subjective quality of life: an interactive model. *Soc Indic Res* 52(1):55–72
- Cummins RA (2005) Moving from the quality of life concept to a theory. *J Intell Disabil Res* 49(10):699–706
- Diener E, Suh E (1997) Measuring quality of life: economic, social and subjective indicators. *Soc Indic Res* 40(1–2):189–216
- Diener E, Biswas-Diener R (2002) Will money increase subjective well-being? *Soc Indic Res* 57(2):119–169
- Diener E, Lucas R, Oishi S (2002) Subjective well-being: the science of happiness and life satisfaction. In: Snyder CR, Lopez SJ (eds) *Handbook of positive psychology*. Oxford University Press, New York
- Dreyer L, Hauschild M, Schierbeck J (2006) A framework for social life cycle impact assessment. *Int J Life Cycle Assess* 11(2):88–97
- Earthster (2008) [www.earthster.org](http://www.earthster.org)
- Edmonds EV, Pavcnik N (2003) Child labor in the global economy. *J Econ Perspect* 19(1):199–220
- Fassa AG, Facchini LA, Dall'Agnol MM, Christiani D (2000) Child labor and health: problems and perspectives. *Int J Occup Environ Health* 6(1):55–62
- Felce D, Perry J (1996) Assessment of quality of life. In: *Quality of Life, Volume I: Conceptualization and measurement*. American Association on Mental Retardation, Washington DC, US
- Flysjö A (2006) Indicators as a complement to life cycle assessment – a case study of salmon. Presentation held 17th of June 2006 in Lausanne
- Forastieri V (2002) *Children at work: health and safety risks*, 2nd edn. International Labour Organisation, Geneva, Switzerland
- Galloway S (2006) *Quality of life and well-being: measuring the benefits of culture and sports: literature review and thinkpiece*. Centre for Cultural Policy Research, University of Glasgow. <http://www.scotland.gov.uk/Publications/2006/01/13110743/0>
- Gauthier C (2005) Measuring corporate social and environmental performance: the extended life-cycle assessment. *J Bus Ethics* 59(1–2):199–206
- Grießhammer R, Benoît C, Dreyer LC, Flysjö A, Manhart A, Mazijn B, Méthot A, Weidema BP (2006) Feasibility study: Integration of social aspects into LCA. Discussion paper from UNEP-SETAC Task Force Integration of Social Aspects in LCA meetings in Bologna (January 2005), Lille (May 2005) and Brussels (November 2005). Freiburg, Germany
- Hunkeler D (2006) Societal LCA methodology and case study. *Int J Life Cycle Assess* 11(6):371–382
- Hunkeler D, Rebitzer G (2005) The future of life cycle assessment. *Int J Life Cycle Assess* 10(5):305–308
- Ilahi N, Orazem P, Sedlacek G (2001) The implications of child labor for adult wages, income and poverty: retrospective evidence from Brazil, Mimeo, Iowa State University, USA. [http://www.grade.org.pe/Eventos/nip\\_conference/private/sedlacek-%20child\\_labor%20retros.pdf](http://www.grade.org.pe/Eventos/nip_conference/private/sedlacek-%20child_labor%20retros.pdf)
- ILO (2007) Child labour wages and productivity: results from demand side surveys. International Programme for the Elimination of Child Labour (IPEC) under the International Labour Organisation, Geneva, Switzerland
- Jørgensen A, Le-Boqc A, Nazakina L, Hauschild M (2008) Methodologies for social life cycle assessment. *Int J Life Cycle Assess* 13(2):96–103
- Jørgensen A, Hauschild M, Jørgensen MS, Wangel A (2009) Relevance and feasibility of social life cycle assessment from a company perspective. *Int J Life Cycle Assess* 14(3):204–214
- Klöpffer W (2003) Life-cycle based methods for sustainable product development. *Int J Life Cycle Assess* 8(3):157–159
- Klöpffer W, Udo de Haes H (2008) Life cycle sustainability assessment of products (with comments by Helias A. Udo De Haes). *Int J Life Cycle Assess* 13(2):89–95
- Labuschagne C, Brent AC (2006) Social indicators for sustainable project and technology life cycle management in the process industry. *Int J Life Cycle Assess* 11(1):3–15
- Levison D, Richard A, Shahid A, Sandhya B (1996) Is child labour really necessary in India's carpet industry? Labour market papers 15. Employment Department, International Labour Organisation, Geneva, Switzerland
- Manhart A, Grießhammer R (2006) Social impacts of the production of notebook PCs – contribution to the development of a product sustainability assessment (PROSA). Öko-Institut e.V, Freiburg, Germany
- Martel JP, Dupuis G (2006) Quality of work life: theoretical and methodological problems, and presentation of a new model and measuring instrument. *Soc Indic Res* 77(2):333–368
- Méthot A (2005) FIDD: a green and socially responsible venture capital fund. Presentation on the Life Cycle Approaches for Green Investment—26th LCA Swiss Discussion Forum, 2005, Lausanne, Switzerland
- Michalos AC (2001) Social indicators research and health-related quality of life research. *Soc Indic Res* 65(1):27–72
- Nazarkina L, Le Bocq A (2006) Social aspects of sustainability assessment: feasibility of social life cycle assessment (S-LCA). EDF 2006, Moret-sur-Loing, France
- Norris GR (2006) Social impacts in product life cycles—towards life cycle attribute assessment. *Int J Life Cycle Assess* 11(1):97–104 (special issue)
- Plous S (2003) The psychology of prejudice, stereotyping, and discrimination: an overview. In: Plous S (ed) *Understanding prejudice and discrimination*. McGraw-Hill, New York, US
- Ray R, Lanchester G (2005) The impact of children's work on schooling: multi-country evidence. *Inter Labour Rev* 144(2):189–210
- Rain JS, Irving ML, Steiner DD (1991) A current look at the job satisfaction/life satisfaction relationship: review and future considerations. *Human Relat* 44(2):287–307
- Schallock RL (1996) Reconsidering the conceptualization and measurement of quality of life. *Quality of life, Volume I: conceptualization and measurement*. American Association on Mental Retardation, Washington DC, USA
- Schallock RL, Brown I, Brown R, Cummins RA, Felce D, Matikka L, Keith KD, Parmenter T (2002) Conceptualization, measurement, and application of quality of life for persons with intellectual

- disabilities: report of an international panel of experts. *American Association on Mental Retardation* 40(6):457–470
- Schmidt I, Meurer M, Saling P, Kicherer A, Reuter W, Gensch C (2004) SEEBalance—managing sustainability of products and processes with the socio-eco-efficiency analysis by BASF. *Greener Manage Int* 45:79–94
- Sirgy MJ, Michalos AC, Ferriss AL, Easterlin RA, Patrick D, Pavot W (2006) The quality-of-life (QOL) research movement: past, present, and future. *Soc Indic Res* 76(3):343–466
- Spillemaeckers S, Vanhoutte G, Taverniers L, Lavrysen L, van Braeckel D, Mazijn B, Rivera JD (2004) Integrated product assessment—the development of the label ‘sustainable development’ for products ecological. *Social and Economical Aspects of Integrated Product Policy*, Belgian Science Policy, Belgium
- Staines GL (1980) Spillover versus compensation: a review of the literature on the relationship between work and nonwork. *Hum Relat* 33(2):111–129
- Tait M, Padgett MY, Baldwin TT (1989) Job and life satisfaction: a re-evaluation of the strength of the relationship and gender effect as a function of the date of the study. *J Appl Psychol* 74(3):502–507
- Udo de Haes HA, Joliet O, Finnveden G, Hauschild M, Krewitt W, Müller-Wenk R (1999) Best available practice regarding impact categories in life cycle assessment. *Int J Life Cycle Assess* 4(2):66–74
- Weidema BP (2006) The integration of economic and social aspects in life cycle impact assessment. *Int J Life Cycle Assess* 11(1):89–96 (special issue)
- WHO (1995) The world health organization quality of life assessment (WHOQOL): Position paper from the World Health Organization. *Soc Sci Med* 41(10):1403–1409
- Williams DR (1999) Race, socioeconomic status, and health: the added effects of racism and discrimination. *An New York Acad Sci* 896:173–188
- Williams DR, Williams-Morris R (2000) Racism and mental health: the African-American experience. *Ethnic Health* 5(3–4):243–68
- World Bank (1997) Expanding the measures of wealth: indicators of environmentally sustainable development. *Environmentally sustainable development studies and monographs series no. 17*. The World Bank, Washington, USA



## **11 Appendix 5: Defining the baseline in Social Life Cycle Assessment**

Jørgensen A, Finkbeiner M, Hauschild M (2010): Defining the baseline in Social Life Cycle Assessment. *International Journal of Life Cycle Assessment* 15 (4) 376-384

## Defining the baseline in social life cycle assessment

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Received: 1 November 2009 / Accepted: 24 February 2010 / Published online: 17 March 2010  
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### Abstract

*Background, aim and scope* A relatively broad consensus has formed that the purpose of developing and using the social life cycle assessment (SLCA) is to improve the social conditions for the stakeholders affected by the assessed product's life cycle. To create this effect, the SLCA, among other things, needs to provide valid assessments of the consequence of the decision that it is to support. The consequence of a decision to implement a life cycle of a product can be seen as the difference between the decision being implemented and 'non-implemented' product life cycle. This difference can to some extent be found using the consequential environmental life cycle assessment (ELCA) methodology to identify the processes that change as a consequence of the decision. However, if social impacts are understood as certain changes in the lives of the stakeholders, then social impacts are not only related to product life cycles, meaning that by only assessing impacts related to the processes that change as a consequence of a decision, not all changes in the life situations of the stakeholders will be captured by an assessment following the consequential ELCA methodology. This article seeks to identify these impacts relating to the non-implemented product life cycle and establish indicators for their assessment.

Responsible editor: Tom Swarr

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*Materials and methods* A conceptual overview of the non-implemented life cycle situation is established, and the impacts which may be expected from this situation are identified, based on theories and empirical findings from relevant fields of research. Where possible, indicators are proposed for the measurement of the identified impacts.

*Results* In relation to the workers in the life cycle, the non-implemented life cycle situation may lead to increased levels of unemployment. Unemployment has important social impacts on the workers; however, depending on the context, these impacts may vary significantly. The context can to some extent be identified and based on this, indicators are proposed to assess the impacts of unemployment. In relation to the product user, it was not possible to identify impacts of the non-implemented life cycle on a generic basis.

*Discussion* The assessment of the non-implemented life cycle situation increases the validity of the SLCA but at the same time adds a considerable extra task when performing an SLCA. It is therefore discussed to what extent its assessment could be avoided. It is argued that this depends on whether the assessment will still meet the minimum criterion for validity of the assessment, that the assessment should be better than random in indicating the decision alternative with the most favourable social impacts.

*Conclusions* Based on this, it is concluded that the assessment of the non-implemented life cycle cannot be avoided since an assessment not taking into account the impacts of the non-implemented life cycle will not fulfil this minimum criterion.

*Recommendations and perspectives* To mitigate the task of assessing the impacts of the non-implemented life cycle, new research areas are suggested, relating to simpler ways of performing the assessment as well as to investigations of

whether the effect of SLCA can be created through other and potentially simpler assessments than providing an assessment of the consequences of a decision as addressed here.

**Keywords** Consequential SLCA · Effect · Non-production · Non-use · SLCA · Social LCA · Unemployment · Usability · Validity

## 1 Introduction

In recent years, there has been an increasing interest in the development of the so-called social life cycle assessment (SLCA).<sup>1</sup> The SLCA can in many regards be seen as a parallel to the environmental life cycle assessment (ELCA), but rather than focusing on environmental impacts, the SLCA focuses on social impacts of products, processes, services or systems (here simply termed ‘products’) in principle throughout their life cycle.

As in the development of all tools or methods, it is designed to facilitate a certain outcome or goal implying that not all method designs (in our case SLCA designs) are equally satisfactory. A goal for SLCA, to which many researchers working with the development of SLCA, including the authors of this article, seem to agree, is to improve social conditions for the stakeholders on which impacts are assessed in the SLCA.<sup>2</sup> It is for example stated in the recently published ‘Guidelines for Social Life Cycle Assessment of Products’ from the task force under the UNEP-SETAC Life Cycle Initiative (Benoît and Mazijn 2009) that: ‘The ultimate objective for conducting an SLCA is to promote improvement of social conditions and of the overall socio-economic performance of a product throughout its life cycle for all of its stakeholders’. Accordingly, SLCA is to be more than just a ‘feel good’ tool; it should be a ‘do good’ tool. Ensuring a positive effect of SLCA on the assessed stakeholders is therefore here considered a requirement to the design of SLCA.

<sup>1</sup> For earlier work on social aspects in LCA, see Benoît and Mazijn (2009), Klöpffer and Udo de Haes (2008), Jørgensen et al. (2008, 2009a, b), Dreyer et al. (2006), Hunkeler (2006), Labuschagne and Brent (2006), Norris (2006), Weidema (2006), Gauthier (2005), Hunkeler and Rebitzer (2005), Schmidt et al. (2004), and Klöpffer (2003). The reader may also refer to the following sources: Earthster (2009), Flysjö (2006), Griefhammer et al. (2006), Manhart and Griefhammer (2006), Nazarkina and Le Bocq (2006), Barthel et al. (2005), Méthot (2005), and Spillemaeckers et al. (2004).

<sup>2</sup> In general, three different stakeholder groups are considered in the SLCA, being the workers throughout the life cycle, the society in which the life cycle is embedded and the product users (Jørgensen et al. 2008). Griefhammer et al. (2006) and Benoît and Mazijn (2009), however, divide this classification even further.

### 1.1 The positive effect of SLCA

As a point of departure in analysing the effect of SLCA, we may ask: How may this positive effect come about? To answer this question, we need an idea of what it is that SLCA does. Here, it is assumed that the main functionality of SLCA is to provide decision support. This decision support may first of all create an effect through decision makers following the ‘advice’ of the assessment hereby making decision makers choose the alternative with the most favourable social consequences. By choosing alternatives, which have more favourable consequences than the alternatives that would have been chosen, had it not been for the SLCA, SLCA can be seen to have created a positive effect. This type of effect of SLCA is here termed the ‘direct effect’. Secondly, the SLCA may also create a positive effect in a more indirect manner, for example through creating incentives in the market for companies to perform well on the issues included in the SLCA. In this article, we will only consider the direct effect, i.e. the effect created from decision makers following the advice of the assessment. How and to what extent SLCA may have indirect effects and how the recommendations for SLCA established here will affect these is considered outside the scope of this article.

In order to create the wanted direct effect from a decision, the SLCA should first of all provide a valid assessment<sup>3</sup> of the social consequences of the decision, hereby allowing the decision makers to choose the alternative with the most favourable social consequences.<sup>4</sup> If the SLCA does not show the true social consequences of a decision, but gives a random representation of these consequences, the decision based on this random advice will equally have a random (direct) effect. And given that a random effect on average will level out, an SLCA giving a completely invalid (i.e. random) assessment of the consequences of a decision will not support the overall goal of

<sup>3</sup> Validity here refers to the degree of correspondence between reality and our perception of it. In line with this, an SLCA is defined as valid if it assesses what we intend it to assess, in this case the true social consequences of a decision. Validity is not to be confused with ‘reliability’, which ‘merely’ relates to reproducibility or the degree to which the result will always be the same if the assessment method is applied on the same situation. An assessment method can thereby be highly reliable without being valid, whereas the opposite is not possible (Carmines and Zeller 1979).

<sup>4</sup> It could be argued that the more indirect effect of SLCA mentioned above should also be accounted for as a consequence a decision may have. Assessing the consequences would therefore also include the assessment of these more indirect effects of SLCA, and the distinction introduced here will therefore be misleading. But, due to the potential complexity of identifying the indirect effects, it seems somewhat unrealistic that an assessment including these could be made.



SLCA stated above. On the other hand, the more validly the assessment expresses the consequences of the decision, the more it will facilitate a positive direct effect, all other things being equal.

Secondly, the SLCA should at the same time be usable in a decision-making context. If the SLCA is not used in a decision context, it will surely not have any beneficial direct effect either. To facilitate the direct effect, the SLCA should thus:

- Be as valid as possible, i.e. assess as accurately as possible what we intend SLCA to assess, which is here the social consequences of a decision
- Be as usable as possible in a decision making context

It seems reasonable to expect that there may be tradeoffs between usability and validity, since a more valid assessment often requires a more laborious approach, making the methodology more impractical and thereby less usable, as argued in several publications (Jørgensen et al. 2009a, b; Dreyer et al. 2006). Here we will however mainly focus on the issue of ensuring the validity of SLCA.

Analysing the validity of SLCA methodologies can conceptually be performed in two ways: Either we can check our assessment result against an already validated standard, or we can analyse the validity of each step in the assessment procedure. In our case, there is no validated standard against which we can compare our results, and therefore the only way to investigate the validity of the result is to address the validity of the assessment procedure.

This article will address the validity of one of the assessment procedures needed in order to assess the social consequences of a decision, namely the assessment of the difference between the situations with and without the decision.

## 1.2 Identifying the difference between ‘is’ and ‘would have been’

The consequence of a decision is not simply the actual situation. More precisely, it can be expressed as the difference between how the world is or will be on the basis of the decision the SLCA is to support and how the world would look like had it not been for this decision. To assess this difference in a valid way, we can to a large extent draw on the existing work on ‘consequential ELCA’, which is equally addressing the issue of assessing the (environmental) consequences of a decision. The key issue in consequential ELCA is ‘...the identification of the unit processes that change as a consequence of a decision’ (Weidema and Ekvall 2009). This is central because the idea in ELCA is that it is where the processes are being carried out, impacts occur and if no processes are being carried out, no impacts occur. However, in SLCA, this is

only partly the case: In SLCA, what we are interested in are social impacts on the stakeholders in the life cycle. If considering stakeholders being persons, which in SLCA may be either the worker or the user (Jørgensen et al. 2008), SLCA is concerned with certain changes in the lives of the worker or the user. This implies that besides occurring when carrying out a process, social impacts may also occur when a product is used, as has already been considered in several SLCA approaches. But, besides this small amendment, changes in lives do not only occur when a process is carried out or a product is used; they occur in all of life’s situations—also when not carrying out a process or using a product. Considering also that the worker or user is ‘occupied’ by carrying out the process or using the product, the worker or the user will have to do something else when the process is not performed or the product not used. This implies that when we are to find the changes that a process or product use creates in the lives of the worker or user, we should not only look at the impacts created by the process or product use, but we should also look at the impacts avoided in the lives that would have been lived, had it not been for the changes in processes or product uses. In other words, the changes to be considered in the life of the worker or user is therefore the impacts associated with the carrying of the process or use of product vs. the impacts of doing something else when not being engaged with the carrying out of the process or use of product.

When it comes to stakeholders being an organisation or institution, in SLCA most commonly the surrounding society (Jørgensen et al. 2008), it seems that the situation is somewhat different: For the surrounding society, it seems that the processes will not interrupt its ‘life’ in the same way as it will for the individual stakeholder. The surrounding society is able to lead its life with and without the carrying out of the process, where the impacts of the process are simply ‘added’ to its life, making the difference to be assessed in SLCA as presented here the impacts associated with the carrying out of the process vs. nothing, just like it is normally done for impacts on the environment in ELCA.

The purpose of this article is to investigate the possibility of analysing how the lives of the workers and users would have been lived, had it not been for the carrying out of a process. The article will also address the impacts associated with these life situations and to the extent possible suggest indicators for their measurement. These life situations will in the following be termed *non-production* (for reasons of simplicity we will here by production refer to extraction, production, disposal and transport) in relation to the workers and *non-use* in relation to the user. As argued above, the third stakeholder often considered in SLCA, the surrounding society, is not seen as relevant in this discussion.

## 2 Method

The impacts of non-production/non-use situations cannot be readily observed: If the product life cycle is implemented, the non-production/non-use situation is not occurring, and if the product life cycle is not implemented, it can be tricky to identify the change that it would have made. This article attempts to give an overview of how the non-production/non-use situation most likely will be followed by a discussion of the impacts associated with these situations. This will be done on the basis of theories and empirical findings from relevant scientific literature. After this modelling, we will address what is needed in terms of indicators in SLCA in order to assess the identified impacts.

### 3 Conceptualising the non-production situation for the workers in the life cycle

The non-production situation can be imagined to lead to a broad range of impacts on the worker and his or her surroundings. Much will therefore depend on the specific setting, which cannot be identified in this generic analysis; however, still it is possible to outline some very possible consequences of the non-production situation for the worker: If it is found through the use of the procedures for performing consequential ELCA that a decision leads to increases in a given production, then it follows that the non-production situation will be associated with a reduced production (in comparison to the production situation). If it is then assumed that on average changes in demand to a production will create proportional changes in demand for work force in the producing company, a direct difference between the production and non-production for the worker is a change in demand for labour. In other words, in the non-production situation, there will be less demand for labour in comparison to the production situation.

According to Carlsson et al. (2006), empirical evidence suggests that decreases in labour demand leads to corresponding increases in unemployment in society if salaries are kept constant. This is assumed in the following.

From this, it would appear that one difference between the production and non-production situation would be given by the employment for a worker in the specific company vs. unemployment for the worker made redundant in the given company. However, some nuances may be added to this picture. First of all, decreasing the demand for a company may not necessarily create unemployment among employees at this specific company. An example could be found in relation to child labour: If working children are fired from one company, they often find employment in another company. This was for example experienced when Bangladesh textile producers in the mid-

1990s decided to fire child workers employed in the industry because of a proposed US ban on import of products produced by children. Consecutive investigations showed that most of the children had found other (and potentially worse) jobs (Lund-Thomsen 2008). In this case, most children were apparently able to avoid unemployment because there was a continued demand for child labour in the surrounding society. It thus seems reasonable in this case as well as in many others (Fineman 1987) to assume that there will be a competitive mechanism among employed and unemployed, creating some kind of hierarchy among the employed and unemployed with the best qualified in the top (in the child labour case, this qualification may be, e.g. low pay), who will rarely face long spells of unemployment, and the least qualified in the bottom, who will face more frequent and longer spells of unemployment. This implies that the one who initially gets fired because of a decrease of demand will not necessarily be the one who will experience the unemployment on the longer term. Rather, the increased level of unemployment in the society will be ‘passed on’, affecting the margin in the ‘qualification hierarchy’.

It thus seems that the non-production situation should be seen as a situation of unemployment, but that unemployment will not necessarily affect the workers who were employed at the company with the decreased production or the surrounding societies. To assess the impacts of the non-production situation, our assessment should be able to take into consideration the impacts on the worker of unemployment. However, it should be noted that the non-production obviously may also lead to other differences for the worker than the difference between being employed (with what this includes) and being unemployed, as the lives of the workers are not completely determined by these two situations. However, in this analysis, this was the only difference found, which is possible to address on a generic basis.

#### 3.1 Impacts of unemployment and decreased production

Impacts of unemployment on the individual have already been relatively thoroughly addressed in literature. An early overview of the field was given by Hakim (1982), who concluded that unemployment affects the individual and its surroundings on four different areas:

1. Unemployment in general affects the physical and mental health and mortality of the individual to the extent that it is concluded that work (with all that it includes) on average improves physical and mental health in comparison to the unemployed situation (with all that it includes) (Waddell and Burton 2006; McLean et al. 2005).



2. Unemployment furthermore deprives the unemployed salary leading to increased levels of poverty for the individual and his or her family or household (Hakim 1982).
3. Very much depending on the financial hardship that unemployment creates for the family or household, unemployment may lead to increased levels of tension, conflicts, decreased physical and mental health of family members, spouse unemployment, divorce, especially in the case of male unemployment, violence in the home and even drops in fertility has been proposed, however, with ambiguous documentation (Ström 2003; Hakim 1982).
4. Unemployment also affects levels of crime, even though it is debated how strong the causation is (Chiricos 1987; Freeman 1999). Not all types of crime are affected equally strongly. In general, it seems that property crime is more clearly affected by unemployment than violent crimes, such as murder, where the causation is weaker (Chiricos 1987; Freeman 1999; Hakim 1982).<sup>5</sup>

To the extent that is relevant, the further consequence of these impacts may be analysed. For example, unemployment and the appertaining decreased mental health may increase expenses for social security and health care in the society, hereby giving rise to new impacts.

What is important to emphasise in relation to these impacts are that several of them can be regarded as ‘impacts on the surrounding society’. Thus, even though it was concluded in the introduction that the direct impacts on the surrounding society from non-production/non-use will be zero, many rebound effects from the impacts on the worker and user from the non-production/non-use situation seem to occur. A more detailed investigation of these indirect impacts on the surrounding society and the importance of these will, however, not be pursued in this study.

### 3.2 Assessing the impacts of unemployment on the workers

To the extent that these impacts are considered relevant to include in an SLCA, the assessment should address the changes in health levels, poverty, family tension and violence and crime.

<sup>5</sup> A word of caution, which should also be mentioned in this respect, is that all studies referred here were performed in the USA, Australia and EU countries. To our knowledge, no African or Asian studies have been made on the above issues. In SLCA, the assessed life cycle will often involve productions on these continents, which raises the question about the possibility of generalising the above results to these continents. Such concerns seem highly relevant, but for now, we will consider the above results as a best guess, also when it comes to countries or continents not covered by the underlying research.

However, it quickly becomes evident that these impacts will not be caused to the same extent in all cases. Literature on unemployment proposes many ‘modifying factors’, which influence how ‘effective’ unemployment or decreased production is in creating the mentioned impacts.

In relation to impacts of unemployment on health, modifying factors are found to be the individual’s socio-economic status, income and degree of financial anxiety, gender, family status, age, education, social capital, social support, previous job satisfaction and reason for job loss, duration out of work, desire and expectancy of re-employment, regional deprivation and local unemployment rates (Waddell and Burton 2006). Taking the extreme cases, being unemployed may result in everything from an increased mental health (if leaving a very stressful job) to death depending on the modifying factors.

In relation to poverty, some modifying factors can be found, as the missed salary due to unemployment may have different consequences for different individuals, families or households, depending on savings, the social security level in the society, the employment situation of the other adult in family (if any) and number of children (Hakim 1982).

In relation to tensions, conflicts and violence in the family or household, financial hardship is important for the prevalence of these impacts, but also other modifying factors like previous experiences with unemployment, coping strategies, cohesion of family and age (Ström 2003).

Finally, some modifying factors in relation to crime have been identified in literature, such as age, sex, income and placement of unemployed in labour market programmes (Freeman 1999; Öster and Agell 2007).

If it is assumed that the purpose of SLCA is to get a valid assessment of the consequences of a decision as possible, it thus seems that since many of the modifying factors are highly personal, the assessment of the impacts of increased unemployment should preferably be performed in a site or case specific manner, indeed, in relation to the individual impacts even on a personal level. But, apart from being highly impractical, this is rarely possible, since we in most situations in an SLCA will not be able to identify which person will be affected by the changed levels of unemployment, as was pointed out above, and therefore we will not be able to identify directly, e.g. what crime is created by the changes in employment.

Instead, we will have to develop semi-quantitative indicators utilising, e.g. the number of unemployed created, coupled with modifying factors identifiable on the societal level, and hereby develop a measure for what kind of impacts we may expect from the unemployment, i.e. ranging from probable high to low impacts depending on the modifying factors (Table 1).

**Table 1** Modifying factors on societal level, which has an influence on how unemployment impacts the individual

Impact	Modifying factor identifiable on societal level
Physical and mental health of unemployed	Level of unemployment in society Level of social security
Poverty	Level of social security
Conflicts and decreased physical and mental health	Level of social security
Crime	Labour market programmes Level of social security (to increase income)

#### 4 Analysing the difference between the use and non-use situation for the users in the life cycle

When discussing the difference between the use and the non-use situation for the users in the life cycle, an important characteristic of products is that the use of products occupies resources, meaning that the use of products tends to inhibit the use of other products or activities in general. Examples of resources may be e.g. time, attention and money, but other resources could be imagined as well. This characteristic has for example been considered in consequential ELCA literature by Thiesen et al. (2008). Here, it is argued that we have a specific, limited amount of money available and that these will always be used. Thus, if not used to obtain the product we are assessing, we call this A; we use our money for something else, B. The non-use situation is, according to this perspective, the impacts related to the provision of B, which is acquired for the money made available by not buying A. In this way, an assessment of the consequences of the life cycle of A will very often become a comparison to what would have been acquired, if not A. However, this identification of consumer behaviour, if not buying product A, can be seen as part of the procedure in consequential ELCA (and SLCA as defined here) to identify which processes will be affected by a decision, in this case the processes relating to the life cycle of either product A or B. Thus, if the only impact on the user would be that s/he would use something else, this would fully be accounted for by following the consequential ELCA methodology, implying that all impacts related to the non-use would be covered. However, this is not entirely true. If we consider that the use of a product for the user occupies not only money but also time and attention, the user will by not using the product have to spend his or her time and attention on something else, which can be something other than using other products. Consider for example that we want to assess whether to buy a TV or not. By not buying the TV, a lot of time and attention will have to be used on something else, which does not have to be related to the use of other products. The user may for example spend time with family and friends, which will have very different impacts on the user. The non-use may in this way be associated with impacts, which will not be

related to other product life cycles and thereby not be caught in an SLCA only considering impacts of production and use. However, it should be kept in mind that not all products will be time and attention consuming. Consider for example a medication, which the user takes to avoid a disease. Such product may bind purchasing power (which can therefore not be used for buying other products) but will hardly occupy any time and attention. In such a case, it therefore seems that the impacts of non-use not related to the provision of other products already considered in the consequential ELCA methodology will be negligible.

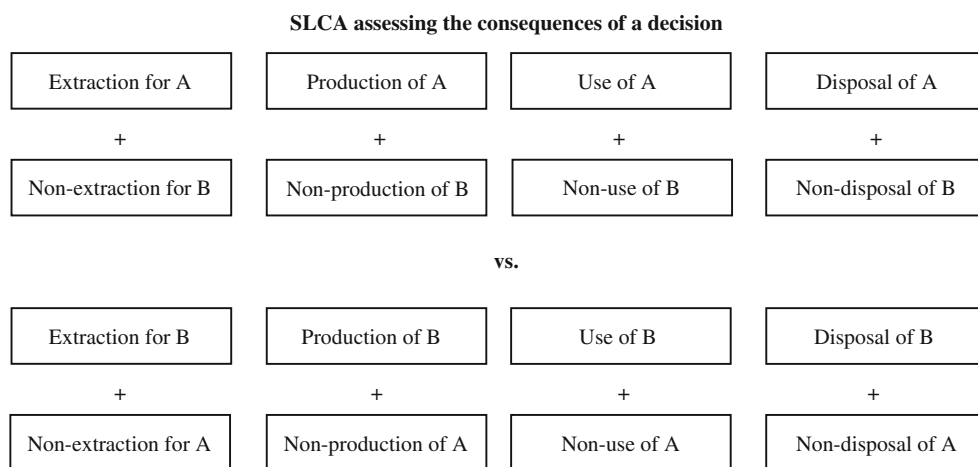
It could be mentioned that there seems to be an impact of non-use in relation to the mentioned medication, in that the user will get ill if not taking it. However, this is rather the effect of the use which is in this case ‘to get well’, i.e. creating the difference between being sick and well. Whether this should be seen as a consequence of use or non-use is a matter of definition; what is important is merely that both the use and non-use situations are properly identified and that no impacts are double counted.

On this basis, it thus seems that there is a difference between use and non-use, which for some products will not be captured without taking into account how time and attention will be spent, if not spent on the product. However, identifying the actual impacts of the non-use and establishing indicators for their measurement is not something we can do on a generic level, since this is fully dependent on the type of product. This question therefore has to be dealt with on a case to case basis.

#### 5 Concluding remarks and perspectives

If SLCA is to have an effect on the stakeholders in the life cycle of the assessed product, one aspect of crucial importance is SLCA’s ability to perform valid assessments of the consequences of a decision relating to products. One aspect of this is to assess the difference between the implemented and non-implemented decision. At this point, it is important to realise that social impacts on individuals do happen not only in product life cycles but also in all aspects of their life. Thus, if a decision implies that a

**Fig. 1** The structure of an SLCA for assessing the consequences of a decision between product A and B. If the decision of whether to choose A does not imply the choice of any other product, B, all stages related to B will be 0. In ELCA, all ‘non’ stages would normally be assumed to be 0



worker participates in a product life cycle or a user uses a product, the worker or user will, if the decision is not taken, have to do something else, which will equally impose some impacts on him or her.

This article has sought to identify the impacts associated with this non-production and non-use and to the extent possible establish indicators for their assessment.

The analysis showed that when not participating in the product life cycle, one likely consequence is an increased unemployment for the worker leading to a range of serious social impacts. Other changes may also happen, which could not be identified on a generic basis. Not using the product will also lead to changes for the user, most notably probably when the user spends a lot of time and attention on the product. However, what social impacts this may lead to could also not be identified on a generic basis, but has to be addressed on a case by case basis, and it is therefore unknown whether the impacts associated with the non-use are important. An overview of the structure of the SLCA is outlined here (see Fig. 1).

On this basis, it seems that in order to assess the social consequence of a decision as validly as possible, the assessment should include the assessment of at least the impacts on the workers that are related to non-production and potentially also impacts on the users from non-use. However, as already mentioned in the introduction, there may often be a trade-off between validity of the assessment on one side and usability on the other and performing the assessment as indicated above seems like no exception. There may therefore be situations where it is preferable to perform the assessment as simple as possible. Assuming that the goal of the assessment is to illustrate the consequences of a decision, the question of whether the assessment of the non-production/non-use situations can be disregarded depends on whether the assessment will still live up to the minimum criteria raised in the introduction, which was that the assessment on average should be better

than random choice in relation to indicating the right decision.<sup>6</sup>

An answer to this somewhat complex question can be deduced from the overall goal of the SLCA as presented here, which is to assess the consequence of a decision: As already outlined, the consequence is the difference between two situations, in our case is then the difference between the production/use situation and the non-production/non-use situation. But, if this is the case, then by only assessing the production/use situation, we are only measuring a state, not a change, which is here assumed to be the goal. In other words, only assessing the production/use situation would, e.g. be like answering the question ‘Will it become better?’ with the answer ‘It will be good’.

If we assume that there is no correlation between the impacts of the production/use and the non-production/non-use situations, then the answer to the above question would be no: Assessing only the state and basing ones decision on that would not be better than basing ones decision on no assessment at all. This is especially the case, when considering that the impacts of non-production are as important and varied as outlined above; in many cases, even more important to those of work (in relation to health impacts of unemployment), varying from ‘increased mental health’ to ‘death’. Thus, simply assuming them to be negligible or the same in all situations and thereby dismissible is no more reasonable than dismissing the impacts of the production/use situations.

<sup>6</sup> For the assessment to be better than ‘no assessment’, it has to show the best of two alternatives more than 50% of the time. The best or right decision is the one causing the most favourable social impacts for now and within a timely limited future. The assessment has to be limited timewise, because for an assessment to show the best alternative, more than 50% of the time in a case with infinite time horizon and therefore also infinite consequences would call for an infinitely complex, and therefore also unrealisable, assessment.

However, the assessment of the impacts of both the implemented and the non-implemented life cycle does not have to be perfect for the assessment to live up to the lowest acceptable validity level of being better than random choice; a great deal of uncertainty is needed before the assessment produces a random result or something even worse. And as already outlined above, including the impacts of non-production, or at least a rough measure of some of these, may not necessarily be that difficult or impractical, as impacts may be based on, e.g. the number of unemployed created together with societal characteristics such as the social security level (see Table 1). This will obviously not create any accurate assessment, but in this case, a crude assessment pointing in the right direction will still give a much more valid assessment than assuming the impacts of non-production to be non-existing and will thus serve as a more acceptable assessment of impacts of non-production.

The assessment of the impacts of non-use seems on the other hand more difficult because of the difficulties in identifying the activities of the user in this situation. However, it should be emphasised that the analysis did not show to what extent the impacts of the non-use situation is important and thus how important this is to include in the assessment. If these impacts show to be important, it may be that some averages of impacts of life situations in general can be found, which may be used as very crude approximations. The importance of these impacts and an approach for their assessment thus seems as a relevant topic for future research.

Besides this topic, several other questions relating to the non-production/non-use situations have not been addressed in this article but seem relevant to analyse. One is the question about how significant the rebound effects on society from non-production and non-use are, which were mentioned but not further discussed in Section 3.1. Another is to what extent other impacts on the worker than the ones relating to unemployment can be identified from the non-production situation. And finally, it seems relevant to address how it would influence the results from this article to include a more dynamic model of the interplay between labour markets and salary levels, which in this article was assumed static.

## References

- Barthel L, Wolf MA, Eyerer P (2005) Methodology of life cycle sustainability for sustainability assessments. Presentation on the 11th Annual International Sustainable Development Research Conference (AISDR), 6th–8th of June 2005, Helsinki, Finland
- Benoît C, Mazijn B (2009) Guidelines for social life cycle assessment of products. UNEP/SETAC Life Cycle Initiative. Druk in de weer, Belgium
- Carlsson M, Eriksson S, Gottfries N (2006) Testing theories of job creation: does supply create its own demand? Sveriges Riksbank Working Paper Series No. 194. <http://www.tinbergen.nl/cost/london/eriksson.pdf>
- Carmines EG, Zeller RA (1979) Reliability and validity assessment: reliability and validity assessments. Sage, Beverly Hills
- Chiricos TG (1987) Rates of crime and unemployment: an analysis of aggregate research evidence. *Soc Probl* 34(2):187–212
- Dreyer L, Hauschild M, Schierbeck J (2006) A framework for social life cycle impact assessment (10 pp). *Int J LCA* 11(2):88–97
- Earthster (2009). [www.earthster.org](http://www.earthster.org)
- Fineman S (1987) In: Fineman S (ed) Unemployment: personal and social consequences. Tavistock, London
- Flysjö A (2006) Indicators as a complement to life cycle assessment—a case study of salmon. Presentation held 17th of June 2006 in Lausanne
- Freeman RB (1999) The economics of crime. In: Ashenfelter O, Card D (eds) *Handbook of labor economics*, volume 3, chapter 52. Elsevier Science, New York
- Gauthier C (2005) Measuring corporate social and environmental performance: the extended life-cycle assessment. *J Bus Ethics* 59 (1–2):199–206
- Griebhammer R, Benoît C, Dreyer LC, Flysjö A, Manhart A, Mazijn B, Méthot A, Weidema BP, (2006) Feasibility study: integration of social aspects into LCA. Discussion paper from UNEP-SETAC Task Force Integration of Social Aspects in LCA meetings in Bologna (January 2005), Lille (May 2005) and Brussels (November 2005). Freiburg, Germany
- Hakim C (1982) The social consequences of high unemployment. *J Soc Policy* 11(4):433–467
- Hunkeler D (2006) Societal LCA methodology and case study (12 pp). *Int J LCA* 11(6):371–382
- Hunkeler D, Rebitzer G (2005) The future of life cycle assessment. *Int J LCA* 10(5):305–308
- Jørgensen A, Le-Boqc A, Nazakina L, Hauschild M (2008) Methodologies for social life cycle assessment. *Int J LCA* 13(2):96–103
- Jørgensen A, Hauschild M, Jørgensen MS, Wangel A (2009a) Relevance and feasibility of social life cycle assessment from a company perspective. *Int J Life Cycle Assess* 14(3):204–214
- Jørgensen A, Lai LCH, Hauschild M (2009b) Assessing the validity of impact pathways for child labour and well-being in social life cycle assessment. *Int J Life Cycle Assess* 15(1):5–16
- Klöppfer W (2003) Life-cycle based methods for sustainable product development. *Int J LCA* 8(3):157–159
- Klöppfer W, Udo de Haes H (2008) Life cycle sustainability assessment of products (with Comments by Helias A. Udo De Haes). *Int J LCA* 13(2):89–95
- Labuschagne C, Brent AC (2006) Social indicators for sustainable project and technology life cycle management in the process industry. *Int J LCA* 11(1):3–15
- Lund-Thomsen P (2008) The global sourcing and codes of conduct debate: five myths and five recommendations. *Dev Change* 39 (6):1005–1018
- Manhart A, Griebhammer R (2006) Social impacts of the production of notebook PCs—contribution to the development of a Product Sustainability Assessment (PROSA). Öko-Institut e.V., Freiburg
- Mclean C, Carmona C, Francis S, Wohlgemuth C, Mulvihill C (2005) Worklessness and health—what do we know about the causal relationship? Evidence review. Health Development Agency. [http://www.nice.org.uk/niceMedia/documents/worklessness\\_health.pdf](http://www.nice.org.uk/niceMedia/documents/worklessness_health.pdf)
- Méthot A (2005) FIDD: a green and socially responsible venture capital fund. Presentation on the Life Cycle Approaches for Green Investment - 26th LCA Swiss Discussion Forum, 2005, Lausanne, Switzerland

- Nazarkina L, Le Bocq A (2006) Social aspects of Sustainability assessment: feasibility of Social Life Cycle Assessment (S-LCA). EDF, Moret-sur-Loing, France
- Norris GR (2006) Social impacts in product life cycles—towards life cycle attribute assessment. *Int J LCA* 11(1 special issue):97–104
- Öster A, Agell J (2007) Crime and unemployment in turbulent times. *J Eur Econ Assoc* 5(4):752–775
- Schmidt I, Meurer M, Saling P, Kicherer A, Reuter W, Gensch C (2004) SEEBalance—managing sustainability of products and processes with the socio-eco-efficiency analysis by BASF. *Green Manag Int* 45:79–94
- Spillemaeckers S, Vanhoutte G, Taverniers L, Lavrysen L, van Braeckel D, Mazijn B, Rivera JD (2004) Integrated product assessment—the development of the label ‘sustainable development’ for products ecological, social and economical aspects of integrated product policy. Belgian Science Policy, Belgium
- Ström S (2003) Unemployment and families: a review of research. *Soc Serv Rev* 77(3):399–430
- Thiesen J, Christensen TS, Kristensen TG, Andersen RD, Brunoe B, Gregersen TK, Thrane M, Weidema BP (2008) Rebound effects of price differences. *Int J LCA* 13(2):104–114
- Waddell G, Burton KA (2006) Is work good for your health and well-being? TSO, London, <http://www.workingforhealth.gov.uk/documents/is-work-good-for-you.pdf>
- Weidema BP (2006) The integration of economic and social aspects in life cycle impact assessment. *Int J LCA* 11(1 special issue):89–96
- Weidema BP, Ekvall T (2009) Guidelines for applications of deepened and broadened LCA. Chapter for CALCAS deliverable D18. [http://www.lca-net.com/files/consequential\\_LCA\\_CALCAS\\_final.pdf](http://www.lca-net.com/files/consequential_LCA_CALCAS_final.pdf)