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SOCIETAL LIFE CYCLE ASSESSMENT

Defining the baseline in social life cycle assessment

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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.

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

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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).[1] 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.[2] 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.

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[3] of the social consequences of the decision, hereby allowing the decision makers to choose the alternative with the most favourable social consequences.[4] 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

[1] 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), Grießhammer et al. (2006), Manhart and Grießhammer (2006), Nazarkina and Le Bocq (2006), Barthel et al. (2005), Méthot (2005), and Spillemaeckers et al. (2004).

[2] 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). Grießhammer et al. (2006) and Benoît and Mazijn (2009), however, divide this classification even further.

[3] 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).

[4] 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).[5]

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.

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 as valid an 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).

[5] 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.

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

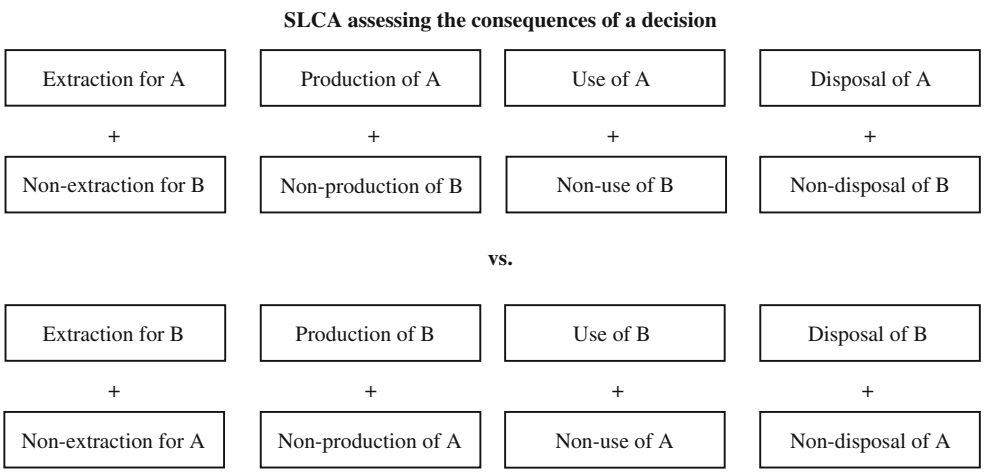

Fig. 1 The structure of an SLCA for assessing the consequences of a decision between product A and B. If the decision of whether to choose A does not imply the choice of any other product, B, all stages related to B will be 0. In ELCA, all 'non' stages would normally be assumed to be 0

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.[6]

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.

[6] 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.

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