Integrating Happiness Research into Endpoint Indicators of Social Life Cycle Analysis

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Endpoint indicators for social life cycle analysis (S-LCA) are still less consolidated than those for environmental LCA. There is a broad consensus that human well-being should be the overarching goal of social sustainability and therefore also of S-LCA. However, to date the two major databases for S-LCA are restricted to a multiplication of working hours with a quality- or risk-adjusted factor. This paper aims to evaluate the congruence between this technical pragmatism and well-established findings of happiness research. The analysis starts with the argument that evidence and consequentiality are necessary criteria for any variables used. It is then shown that some of the variables such as poverty are not consequential, while the unit of working hours lacks any evidence about a relationship with subjective well-being. The analysis concludes that a simple point-based endpoint indicator would be more appropriate for S-LCA than the current hour-based indicator.

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Introduction

Endpoint indicators in life cycle analysis are appreciated for their simplicity and openness to interpretation, while their subjectivity is sometimes a reason for debate (Cays 2021). Models for the aggregation of environmental parameters like ReCiPe (Goedkoop et al. 2009) have become important tools to compare the environmental footprint between different products (Dekker et al. 2020), different production sites (Turk et al. 2020) and different time periods (Sanyé-Mengual and Sala 2023).

For social life cycle analysis (S-LCA), the situation is more difficult. It is a much younger methodology with a less established body of research (Bachmann et al. 2024). A literature review identified a lack of standards

and code of practice (Arcese et al. 2018). Most empirical work is done either based on the Social Hotspot Database (SHD) (e.g. Diaz-Chavez 2015; Pérez-Lopez et al. 2025) or the PSILCA (Product Social Impact Life Cycle Assessment) database (e.g. Di Noi et al. 2020; Tragnone et al. 2023). But how sound are the endpoint indicators used by these sources in the context of the method's ambition?

This is the question that our study aims to answer. It contributes to consolidation of social LCA methods through a critical analysis of current endpoint indicators. To this end, it starts by demonstrating the major gap between necessary prerequisites for a credible endpoint indicator of S-LCA as set out in basic reference documents and the much more modest approaches used in practical tools. It then shows why happiness research is an important source of relevant information in the definition of an endpoint indicator for S-LCA. On this normative base, the most important indicators currently used in S-LCA are evaluated. From these foundations we derive suggestions for useful S-LCA endpoint indicators. This work makes contributions to simplifying current standards.

State of Endpoint Indicators in S-LCA

There is a consensus that an endpoint indicator in S-LCA should not be a general indicator on social welfare but should restrict itself to the sphere of work. S-LCA aims to assess the social footprint of products (Burchi et al. 2013), meaning that only social aspects arising with the work required to produce the products should be considered. The most important reference guide for S-LCA by United Nations Environment Programme (2020) sends clear signals in terms of the S-LCA most suitable endpoint indicator: it suggests that 'midpoint covers the characterization of impact midway through the cause-effect chain and endpoint at the stage of Area of Protection, i.e. the final impact on human well-being' (United Nations Environment Programme 2020, 53). This quote includes two important notions. One is the reference to what is called 'areas of protection' in environmental LCA, which usually describes an analysis's methodological focus such as natural resources or human health. Whatever the concrete area of protection is, it is to be covered in total by endpoint indicators as described by Finnveden et al. (2009). The second notion is that human well-being is the most basic indicator, as will be shown in detail below.

However, the more we move from theory towards practical implementations of S-LCA the more difficulties arise. As the ambition of well-being indicators usually cannot be met on a sufficiently disaggregated lev-

el, workarounds are the rule rather than the exception (Weidema 2018). More recently, Weidema (2023) produced promising results using quality- and disability-adjusted life years. However, all the major databases work with endpoint indicators with less clear reference to well-being. Usually, the endpoint indicators are a composite of working hours and some risk- and quality-related variables. The Social Hotspot Database, for example, constructs the Social Hotspots Index that uses information about: (1) wage, (2) poverty, (3) child labour, (4) forced labour and (5) discrimination and equal opportunities to construct the quality of labour. This is then combined with the hours of working time to calculate the social sustainability index (Takeda et al. 2019). Similarly, the PSILCA database uses risk-adjusted working hours as their unit of product comparison (Martínez-Muñoz et al. 2022). In an attempt to broaden the range of social effects that can be included in an S-LCA, the authors of the database recently incorporated an option to carry out what they call a 'direct quantification of indicators' (Maister et al. 2020), but this does not support aggregation and therefore does not lead to an endpoint indicator. Thus, the relationship between the indicators used in the practice of applied S-LCA and the impact of production on human well-being remains unanswered. To approach this question, it is useful to come back to the essence of social sustainability.

Social Sustainability, Utilitarianism and Happiness Research

The strong link between S-LCA and happiness research can be identified in a few dimensions. First and foremost S-LCA refers to the social pillar of sustainability. However, it has often been remarked that this social pillar has the largest uncertainties in its definitions (Janker and Mann 2020; Biswas et al. 2021; Jankovič 2023). Awan et al. (2018, 70), for example, suggest that the aim of social sustainability 'is to have value for the survival of current business system (customers, partners, and society) and its growth for the future generation equitably and prudently'. Golrang (2015, 50) in contrast argues that 'the main focus and aim of social sustainability is normally to see in the inhabitant's needs, life conditions and social justice'. The difference between the two quotes can be explained by the different environments in which the two studies are embedded: the first is a business context, the second concerns a spatial location. Yet, despite such contextual differences it can still be argued that it is easier to identify an ultimate goal of the social than of the environmental pillar of sustainability. It will always be difficult to weigh the objective of clean

air against the objective of biodiversity. In contrast, the concept of social sustainability aligns well with basic ethical concepts.

Deontological arguments focus on the realization of human rights and claim that these rights are the backbone of social sustainability. Treviño-Luzano (2022), for example, compares infrastructure projects with respect to the handling of human rights and draws conclusions on their impact on social sustainability. Popovic et al. (2018) go as far as collecting social sustainability endpoint indicators (mainly outside of S-LCA) that can be traced back to human rights. Utilitarians, in turn, consider human well-being the only relevant goal for making ethical decisions, because all other relevant attributes such as trust and justice will ultimately result in higher subjective well-being. Scholars in this tradition point to the link between well-being and social sustainability. While it is widely accepted that individual predispositions and the family environment have a great effect on subjective well-being (Savahl et al. 2020), it is also acknowledged that other social factors have significant impacts (Adler and Seligman 2016). Rogers et al. (2012) suggest monitoring the different social components of well-being such as physical and social security or social relationships to identify progress in social sustainability. Arcagni et al. (2021) point to the complexity of social phenomena that needs to be considered when measuring social sustainability. Moreover, Conigliaro (2021) demonstrates how decent work (embracing universal individual rights, human needs and social justice) links social sustainability to human well-being. Even though a high level of social sustainability will not automatically translate into a high level of subjective well-being, for example because individual subjects take others or past situations as a reference (e.g. Caporale et al. 2009; Schokkaert et al. 2011), there are important utilitarian arguments for aiming at social sustainability.

The one-dimensionality of utilitarianism (Binder 2009) aligns well with the search for an endpoint indicator. Following the basic utilitarian argument, obviously the contribution of a production process to human well-being must be the ultimate normative scale for such an endpoint indicator. In other words: although it may be difficult to identify how a production process contributes to social well-being, it remains the only relevant question for an S-LCA, to which any endpoint indicator should be tailored as well as possible. Thus, if it would be possible to directly measure the impact of a certain production process on well-being in the respective society, this would be the perfect endpoint indicator for S-LCA. These considerations help in justifying the United Nations Envi-

ronment Programme's (2020) suggestion to use human well-being as an indicator.

However, even when it is easier to agree on human well-being as the ultimate indicator of social sustainability, there remains the problem of its operationalization. It is impossible to monitor subjective well-being in a country such as Kenya without tea farming or in a country such as Japan without car production, which make it difficult to estimate the effect of these sectors on human well-being. And even if it would be possible to show that people in the hotel business are happier than those in the consulting business, it remains unclear whether the difference in work life is the main cause for this difference. This raises the question: is the proxy used as an endpoint indicator in S-LCA, the combination of work hours and work quality, as close a proxy as we can get?

To answer this question, two principles need to be followed which are well established in environmental LCA but often ignored in S-LCA and other social evaluation methods:

1. *An endpoint indicator has to be evidence-based.* Over the course of the last 60 years, happiness research has become a thriving research field with ample empirical evidence about subjective well-being and its main causes (Delsignore et al. 2021). Every major variable with an impact on human subjective well-being should have been discovered by now. This justifies a reduction of the variables used in S-LCA to those factors which have been shown to increase or decrease subjective well-being. Using an indicator like indebtedness, for example as by Williams et al. (2024), is only meaningful if indebtedness has been shown to have a measurable impact on the well-being of farmers or other relevant stakeholders.
2. *An endpoint indicator has to be consequential.* As in environmental LCA, the indicators used in S-LCA should confine themselves to measurable effects of the production and therefore be consequential, as implied in utilitarianism (Miller 2013). Garcia-Sanchez et al. (2023), for example, include access to sanitary services as a variable in their S-LCA analysis. This leads to more favourable assessments in richer countries and leads to a negative evaluation of countries where sanitary facilities are rare. However, access to sanitary services should make life easier, more pleasant and healthier (Zhou et al. 2021); the core question is whether the production process assessed leads to a change in workers' access to sanitary facilities. As in en-

vironmental LCA (Schulz et al. 2020), credible reference scenarios have to be defined describing the likely situation without the respective production process. Only if the production process changes workers' access to sanitary services for the better or for the worse, should such an indicator be included.

An Evaluation of S-LCA Endpoint Indicators

It has been shown above how S-LCA uses indicators in practice which are supposed to correlate with individual well-being. As these indicators usually have a quality component and a work time component, it is useful to have a separate look at each of them.

QUALITY COMPONENTS

People usually spend a major share of their life time at their workplace or at least in a work relationship. Hence, an established finding is that subjective work quality is an important driver of subjective well-being (Dockery 2005). However, subjective work quality is not something that can, and typically would, be included in an S-LCA, as it is aimed at using data for indicators that are as objective as possible. The introduction of subjective indicators in an LCA-based system would open too many possibilities for manipulating results. Considering that 'the study of workplace happiness is one of the most advanced and long-established branches of happiness scholarship' (Thin 2012, 379), a key question is whether there are objective work quality indicators that are used by S-LCA and have an empirically robust relationship to subjective well-being.

We can come up with some answers to this question when we analyse factors used by the Social Hotspot database (Benoit-Norris, Cavan et al. 2012), one of the major data suppliers in the field, and check whether these factors fulfil the conditions of being evidence-based and consequential. It is beyond this paper's scope to cover all 26 quality components. Hence, the five with the greatest possible heterogeneity will be examined in greater depth.

Wage Assessment

As proxy to determine whether wage may be an issue in a country-specific sector, this subcategory assesses whether the country-specific sector average wage is below or above some relevant thresholds: the country minimum wage, the country living wage

> and the country Sweat free wage [Benoit-Norris, Bennema et al. 2018, 29].

The first question to be answered is the connection between income and subjective well-being as the methodological focus of happiness research. Although this correlation is easily overestimated and weakening in higher income classes (Mahadea and Rawat 2008; Sengupta et al. 2012; Chomentauskas and Paulauskaité 2020), it is stable and largely uncontested (Graham 2011). This fact satisfies the condition of empirical validation, but not yet of consequentiality.

The issue of consequentiality comes down to the question: is it better from a happiness perspective that garment production is carried out in a country where the individual income in the sector is higher than the average income across all sectors? This question can be answered affirmatively. It can be that wages in the garment sector are higher than in other sectors because the country is extremely poor and all other sectors are extremely unproductive. In this case, the criterion privileges poorer countries. Due to the 'declining marginal utility of wealth' (Popp 2011, 70), this would increase overall well-being. It could also be that the garment sector in a country generates above-average wages because of its high productivity or its strong unions. In these cases, it is obvious that maintaining jobs for well-paid workers will generate more utility than maintaining jobs for workers with a low income. Therefore, the indicator 'wage assessment' is also consequential in the sense that its consideration will shift production into countries where the sector's productivity is high, which will increase overall utility and hence subjective well-being for wage workers (Laporšek et al. 2021).

Poverty

> Poverty is 'unacceptable deprivation in human well-being'. The poverty rate is the ratio of the number of people whose income falls below the poverty line [Benoit Norris, Bennema et al. 2018, 34].

The same simple judgement applies to the empirical validation of poverty as in the case of wage assessment. The effect of income on subjective well-being is strongest in lowest income groups. Therefore, poverty is not only an 'unacceptable deprivation', but also detrimental to human well-being.

The problem of the poverty criterion lies in consequentiality. Poverty as a proxy for subjective well-being in S-LCA discriminates against poor

countries and, vice versa, trade-flows shift towards wealthier countries of origin. This, in turn, will aggravate international inequalities, that will overall tend to have a negative instead of a positive impact on human subjective well-being. This is an important difference compared to the wage assessment variable: while the latter focuses on an intersectoral comparison, poverty is taken into account nationwide, losing therefore the direct link to the specific sector and the production conditions. Fair trade coffee, for example, may still be discriminated against with the 'poverty' criterion if it occurs in the 'wrong' country.

The poverty criterion is a good example for the importance of consequentiality. Production in an extremely poor environment does not necessarily support social sustainability. However, poor regions do not have a chance to escape their precarious living conditions if they cannot generate added value through engagement in economic activities such as those subjected to S-LCA. It is dangerous and ultimately absurd if the option of engaging in an economic activity is made impossible due to a bad result of an S-LCA.

Child Labour

> UNICEF data regarding the percentage of children aged 5-14 years engaged in child labor is integrated in the SHD besides data from the Understanding Children's Work (UCW) database. The UCW database is compiled by UNICEF, ILO, [International Labour Organisation] and the World Bank and includes data about the percentage of children working by economic sector aiming at producing research to inform policies in the area of labour and youth employment [Benoit Norris, Bennema et al. 2018, 39].

The evidence on whether child labour has a direct and negative impact on human well-being is unclear and blurred. In a meta study, Kinasih (2023) finds both positive effects like a higher self-esteem and also negative impacts like increased stress. Another, more complex line of argumentation leads to a larger and clearer body of empirical evidence: many studies show that child labour has a negative impact on education (Beegle et al. 2009; Buonomo Zabaletta 2011; Abdelfattah 2015). The time during which children have to work is unavailable for school attendance or doing homework. Moreover, it is an established research finding that education is a predictor of subjective well-being: studies by Cuñado and de Gracia (2012), Chen (2012) and Jongbloed (2018), for example, show

that all levels of education contribute to higher levels of well-being, directly and through additional mediating variables.

As it is easy to recognize that child labour fulfils the criterion of consequentiality, S-LCA can contribute to avoiding production systems and regions in which children play a significant role. This is likely to contribute to human well-being.

Forced Labour

> This subcategory provides an assessment of the risk of forced labour by country and by country-specific sector. The Global Slavery Index (GSI) 2016 provides a quantitative ranking of 167 countries around the world according to the estimated prevalence of slavery, that is, the estimated percentage of enslaved people in the national population at a point in time [Benoit Norris, Bennema et al. 2018, 39].

The social worlds that include forced labour are commonly hidden from the public. It is therefore usually impossible to carry out standardized surveys among labourers being forced into their job, and the empirical evidence about the effects of forced labour on subjective well-being is mostly restricted to single cases in which affected persons say they were or are unhappy with conditions under which they have to work (LaFraniere 2006).

However, there is clear empirical evidence that freedom and subjective well-being are positively correlated (Jackson 2017; Abdur Rahman and Veenhoven 2018), no matter whether these freedoms are political or economic (Animashaun and Ubabukoh 2021). If scientific proof is needed that forced labour is extremely likely to decrease overall wellbeing, this is probably the closest we can get.

The criterion of consequentiality is fulfilled for forced labour. If we know that a product is made by modern slaves, we can contribute to a change to the better if we avoid this product.

Discrimination and Equal Opportunities

> The US department of State's Human rights report provides information on whether or not countries have included principles of non-discrimination in their constitution, whether or not these principles have been transposed into national legislation, if the national governments are enforcing the rules. Based on what is included in

> the constitution, the national law/regulatory system and the level of enforcement by the government combined with information on the existence of discrimination, the risk levels are determined for the different countries [Benoit-Norris, Bennema et al. 2018, 62].

It is not only intuition that tells us that discrimination makes persons unhappy, but also empirical research. Padela and Heisler (2011), for example, show how anti-Arab discrimination in the US after the terror attacks in 2001 makes affected people unhappy. Similarly, unmarried mothers in a tribal setting who perceive themselves as being discriminated against are unhappier than other unmarried mothers (Thasleema and Rajan 2022), and transgender women's discrimination translates into unsubjective well-being (Barrientos et al. 2016). Empirically it is sufficiently validated that discrimination has detrimental effects on subjective well-being. Abid et al. (2020) provide a credible model to understand this nexus through emphasizing the mediating roles of fairness perception and civility.

However, it should be noted that, probably because of easier data access, national rather than sectoral data are used. This suggests that taking the discriminatory degree of countries into account is, similar to poverty, not consequential. For example, avoiding coffee from Uganda is unlikely to make Uganda a less discriminating country and therefore will not make anybody happier.

THE COMPONENT OF WORKING HOURS

The indicators used in S-LCA are usually composed of the variables evaluated above (and others) multiplied by the working hours needed to produce one unit of the good assessed. It is therefore essential to evaluate whether the amount of work time also meets the criteria of evidence and consequentiality.

While the general impact of our work life on subjective well-being is considerable, it is now necessary to examine the literature on the impact of the quantitative component – the number of hours worked – on subjective well-being. Here, the evidence is very limited. We know that flexitime makes workers happier (Okulicz-Kozaryn and Golden 2017), but this is not considered in S-LCA. Golden and Wiens-Tuers (2006) found no net effect of required overtime and heterogeneous effects of mandatory overwork on subjective well-being. There are regional differences in the optimum amount that people prefer to work (Okulicz-Kozaryn

2011), but there is no empirical evidence that human labour should be considered as an evil that should be minimized, reflecting a dogma from medieval times (Voutyras 1980).

In contrast, there is a vast body of literature about the effects of unemployment on human well-being. Winkelmann (2014) emphasizes that bringing people back into work does more for their subjective well-being than compensating them financially. He also demonstrates that unemployment even has a lasting negative effect on subjective well-being including the years after taking up work again. The relationship between unemployment and subjective well-being is extremely stable over differences in time and regional cultures (Di Tella et al. 2003; Kuzu et al. 2019; Barros et al. 2023). It is not appropriate to link this fact too tightly to the use of working hours as an indicator for unhappiness. However, in combination with the lack of evidence that additional work hours decrease subjective well-being, it becomes obvious that the 'working hours' variable is not an evident predictor of unhappiness.

Evidently, the consequentiality of the 'working hours' variable is a given. The production processes require time, and this is operationalized through working hours.

SYNTHESIS

Table 1 summarizes the result of evaluating several variables used for the endpoint indicator in the social hotspot database on the two criteria of consequentiality and evidence. Most variables meet the two criteria, but not all. In particular, poverty in a country will not be alleviated by discriminating against this country, but rather to the contrary. The same applies to discrimination, except if accounting for this discrimination in an S-LCA will set up political pressure. But this is an unlikely presumption. In addition, the number of working hours has no measurable relationship to human well-being, so it is misplaced in an S-LCA.

TABLE 1 Summary of the evaluation of social hotspot database variables

	Consequentiality	Evidence
Wage assessment	✓	✓
Poverty	✓	✓
Child labour	✓	✓
Forced labour	✓	✓
Discrimination	✗	✓
Working hours	✓	✗

For both the SHD and PSILCA databases, the endpoint indicator is the mathematical product of two numbers. Our analysis suggests that one of these numbers is unrelated to well-being as the relevant reference. If this claim is justified, it requires a major reform of endpoint indicators. The current multiplication allows for a tangible hours-based number, whereas an abatement of working hours would only allow for some more abstract index.

In addition, the evaluation of consequentiality has indicated that some slimming on the side of such an index through skipping several of the factors currently integrated would also increase the significance of the endpoint indicator. Indicators relating to the national level seem to be less useful than specific sectoral data, for which the difference between 'wage assessment' and 'poverty' is a good case in point. It is socially beneficial to invest in sectors that generate above-average added value in a country, reflected by good wages. However, it makes no sense to prefer rich countries over poor countries if the aim is to eradicate poverty.

Summary and Conclusions

The S-LCA method is relatively young, so it is no surprise that not all indicators used so far support all principles of current S-LCA. This should be taken into account when acknowledging that the endpoint indicators used in S-LCA have grave weaknesses in terms of their consequentiality and their evidence in relation to subjective well-being. These are two criteria identified as crucial for a meaningful S-LCA. The results of our study lead to the suggestion to slim down the analysis to a few core indicators for which this clear-cut connection with subjective well-being exist.

It is the underlying assumption of both the S-LCA method and this paper that production processes are out of reach for buyers and consumers of the product. The conditions of evaluation change if it is possible to renegotiate production conditions within the value chain. If it was possible, for example, to make binding and reliable agreements to eradicate forced labour in the production process, this would do more for well-being than the avoidance of the product.

To do justice to the overarching objective of well-being in S-LCA, this paper suggests a great need for future research. This includes the development of a consolidated list of appropriate indicators and a sound weighing method. In sum, historically, S-LCA has not grown out of its infancy yet.

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