

Social indicators for meat production – addressing workers, local communities, consumers and animals

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ABSTRACT

Social impacts regarding the production of meat are on the agenda, especially due to reoccurring problems, like food hygiene, the use of antibiotics and disregard of animal's welfare. Thus, the assessment of social impacts for meat production seems essential, but has not been determined within social life cycle assessment (SLCA), yet. As pork has the biggest proportion of the global meat production per mass; the focus of this study is on pork production. The SLCA method is used to address the related impacts. Currently it addresses only human beings, while completely neglecting the impacts on animal's life. Therefore, this study aims to integrate animals into SLCA alongside the common stakeholder groups' workers, local communities, and consumers. Indicator sets are developed to assess the value chain of pork. All indicators are allocated to relevant midpoint impacts to indicate impact pathways. Further research is needed regarding the characterization of occurring impacts.

Keywords: social life cycle assessment, animal well-being, indicator development, meat production

1. Introduction

Social impacts regarding the production and consumption of meat are on the agenda. Meat consumption is increasing worldwide. This increase in consumption originated in western civilization, but is also arising in newly industrialized countries like the BRICS¹ states. This causes several problems for societies on a global scale. Most of the occurring problems are connected to industrial animal farming. Feedstuff production is mostly outsourced resulting in monocultures. Animal farming, which is detached from feedstuff production, creates great quantities of manure. Relevant topics in connection with the meat supply chain are popping up not only in the media but also in politics and public discussions. It starts with working conditions of farmers for both animal feedstuff and animal husbandry. Further topics of interest are working conditions of abattoir workers, food hygiene, the usage of antibiotics and hormones within animal farming, and last but not least the animal treatment primarily within industrial farms (Safran Foer 2010; Chemnitz et al. 2014). Especially the latter is gaining increasing awareness within different movements of society. Although, the status of animal rights has not been fully clarified, interest in animal's well-being in connection is increasing, as current practice contradicts with common ethical values of society (Sunstein and Nussbaum 2004; Singer 2006; Daigle 2014). However, current assessment practice of food products in general including meat products is limited to life cycle assessment (Dalgaard 2007; Roy et al. 2009), but no social life cycle assessment (SLCA) has been performed addressing meat production chains. No set of indicators exists considering affected stakeholders due to animal husbandry, feedstuff and meat production or meat consumption processes. Hardly any impacts along the supply chain are covered by current methods. In addition, common SLCA practice (Benoit and Mazijn 2009) is completely neglecting the impacts on animal's life. Facing these shortcomings within this study a set of indicators is developed addressing workers, local communities, consumers and animals. It is focused on pork meat and the related production chain, as it has the highest market share per mass and records increasing rates for emerging countries (Chemnitz et al. 2014).

2. Methods

The pork production chain is examined focusing on the inclusion of indicators by considering feedstuff production, animal farming and slaughter and the consumption of the final product pork (see Figure 1). The focus is on intensive livestock farming, as it contributes with the highest amount to the pork supply. In this connection global supply chains are relevant, as e.g. feedstuff production is up to a great extend outsourced (BLE 2011).

¹ BRICS states are Brazil, Russia, India, China and South Africa.

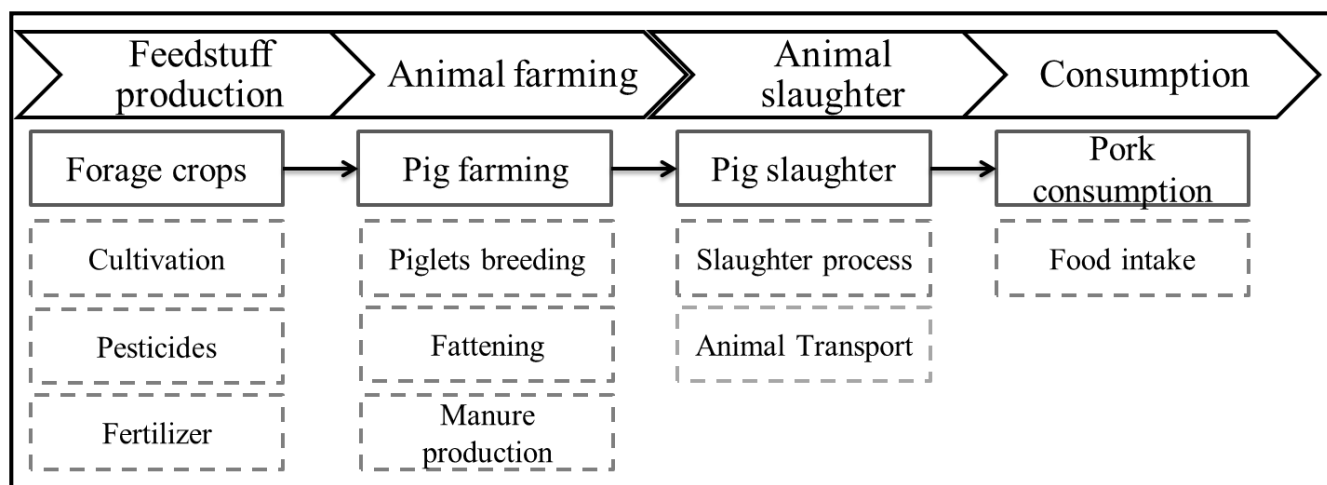


Figure 1: Pork production chain including feedstuff production, animal farming, animal slaughter and the pork consumption; all relevant steps from a SLCA point of view are included

The SLCA method is used, targeting the development of a set of indicators that integrates human as well as animal well-being, which so far is not included into SLCA. It is orientated on the Guidelines of SLCA (Benoit and Mazijn 2009) and the related Methodological sheets (Benoît et al. 2013). It is focused on indicators in connection with midpoint impact categories, addressing aggregated repercussions on human and animal well-being. In addition, existing indicators are analyzed, which are not yet included into SLCA practice. Subsequently, additional indicators are developed to better match the broad range of appearing impacts. Indicators used in SLCA studies are qualitative, semi-quantitative or quantitative (Dreyer et al. 2006) and are provided by different organizations. The Methodological sheets provide guidance for case studies based on indicator approaches, exemplary data sources and relevant international conventions (e.g. conventions of the International Labour Organization) (Benoît et al. 2013). In order to enable a preferably broad indicator review the Global Reporting Initiative (Global Reporting Initiative 2013) and the Product Sustainability Assessment Guidance published by the Institute of Applied Ecology (Grießhammer et al. 2007) are taken into account, too.

According to the guidelines of SLCA (Benoit and Mazijn 2009) five stakeholder groups are defined: workers, local communities, societies, consumers and value chain actors. The stakeholder groups affected can be different dependent on the respective case study. Commonly addressed is the stakeholder group workers, which is in close relation to production processes (Norris 2006b; Klöpffer 2008; Jørgensen 2012). Local communities and consumers are also often considered, e.g. in connection with health aspects. Health issues even if originally located in LCA are shifted to SLCA to avoid double counting and to ensure a consistent separation of social, environmental and economic issues. Value chain actors and societies are more relevant at the organizational perspective, reflecting social responsibility activities (Benoît et al. 2013). Animals are thus far not addressed within SLCA.

Within SLCA two topics are always addressed: workers or working conditions and health aspects (Hunkeler 2006; Norris 2006a; Weidema 2006; Parent et al. 2010; Jørgensen 2012). Besides that another important topic, which is listed quite frequently as well is education. According to the Methodological sheets six midpoint impact categories are defined: human rights, working condition, health and safety, cultural heritage, governance and socio-economic repercussions. However, Benoît et al. (2013) states that these categories can be complemented by further ones. Therefore fair wage and level of education are suggested as additional midpoint categories by (Neugebauer et al. 2014).

3. Considering animals in SLCA

So far animals are not considered within SLCA. However, the consideration of animals or animals' well-being in connection with animal husbandry and farming already has a great history in philosophy. Several philosophers have already discussed the topic of animal rights and the moral responsibility of mankind's behavior with respect to animals. Generally it is focused on the differences and similarities between species and the resulting rights for each species. Highlighted topics in this context are the ability of most animals to feel not only pain and pleasure but also the existence of the inherent will to survive and the presence of future plans (Regan 2004;

Sunstein and Nussbaum 2004; Singer 2006). Especially in connection with industrial animal farming² these topics become highly relevant. Already in the early sixties Harrison (1964) stated the situation of poultry in industrial farms, which resulted in the first public awareness actions against industrial farming. It served as a kick-off for the Brambell Report in 1965 (Brambell 1965) including the five freedoms for farm animals³:

1. Freedom from hunger and thirst - by ready access to fresh water and a diet to maintain full health and vigor
2. Freedom from discomfort - by providing an appropriate environment including shelter and a comfortable resting area
3. Freedom from pain, injury or disease - by prevention or rapid diagnosis and treatment.
4. Freedom to express normal behavior - by providing sufficient space, proper facilities and company of the animal's own kind.
5. Freedom from fear and distress - by ensuring conditions and treatment which avoid mental suffering.

The five freedoms serve as the basis of the European Convention for the protection of animals kept for farming purposes (Council of Europe 1976) and have also been included in the endeavors of the Welfare quality network⁴. However, even if several actions exist the reality shows different, when taking a closer look at the everyday practice in industrial farms. Almost constantly the points 3)-5) are harmed (Safran Foer 2010; FAWC 2011; Chemnitz et al. 2014). Therefore, there is a need to include animal's welfare or well-being into SLCA to address the impacts on animal's life.

4. Results

According to the above mentioned, indicators are selected, developed and allocated to the respective stakeholder group and the affected midpoint category. For each step of the defined life cycle (see Figure 1) relevant stakeholder groups are identified and the related effects are analyzed. Thereafter relevant indicators are taken from existing SLCA studies complemented by own indicators developed to tackle all analyzed effects.

Within the defined life cycle the two stakeholder groups' workers and local communities are directly affected. Workers might be impacted in all production processes from feedstuff production to the animal slaughter, as none of the related processes can get along without manual work. Local communities are always influenced, when boundaries between agriculture and living areas overlap and confounders result from the agricultural activities. The stakeholder group consumers are affected at the end of the supply chain, due to the consumption of pork. The remaining stakeholder groups, value chain actors and societies, are not included in this study, as they are mainly related to companies' behavior reflecting organizations understanding of promoting social responsibility (Benoît et al. 2013). The named stakeholder groups reflect the interest of human well-being, but neglect the impacts on animal's life resulting from animal farming. Addressing these shortcomings, indicators are included representing the impacts on animals life. Following the defined midpoint impact categories for humans (see section 2) three midpoint impacts are considered: animal rights, animal health and species specific repercussions. As the status of animal rights is not finally clarified, it is seen as a subordinated midpoint category. The remaining categories (e.g. fair wage) are assumed as irrelevant for the well-being of animals. The discussion of how to include the proposed indicators into the existing SLCA framework cannot be solved easily, but proposals are given in section 4.4.

4.1. Stakeholder group workers

Along the supply chain for pork production different groups of workers are affected. According to Figure 1 workers in feedstuff production, animal farming and slaughterhouses are considered. Within the feedstuff production the focus is on cereals and soy production processes. Whereas cereals are often produced locally soy production happens mainly in South America (Burley 2008). Workers are impacted due to land grabbing (Burley

² Of course also in connection with animal testing and animal husbandry, but within this study the focus is clearly on animal farming.

³ Provided by the Farm Animal Welfare Council (<http://www.fawc.org.uk/freedoms.htm>)

⁴ Can be accessed under <http://www.welfarequalitynetwork.net/network>

2008; Fritz 2011), forced labor (Sakamoto 2010), disrespect of indigenous rights (Greenpeace 2006; Fritz 2011) and health impacts caused by pesticides (PAN 2010; Fritz 2011).

For workers within the industrial pig farms different impacts are anticipated. The standard of living in connection with indebtedness and fair wages seems to be important, as the historical development of pig farming in Germany shows trends towards mass based industrial farming achieving a minimum of economic efficiency (Korbun et al. 2004). In addition health impacts are relevant due to the existence of MRSA⁵ germs on pig farms (Neeling et al. 2007; Khanna et al. 2008; Frick 2010) and frequent cases of chronic bronchitis and asthma of farmers (Iversen et al. 1988; Vogelzang et al. 1999; Iversen et al. 2000; Radon et al. 2001). Besides, as most of the reviewed farms within this study⁶ are family businesses, child labor might have a small impact. The respective regulations and laws therefore have to be considered.

Workers within modern slaughterhouses are forced to perform a high number of slaughters per hour to be cost-efficient. Thus, the workers are exposed to high psychological pressure, which may result in abnormal behavior (Bundestierärztekammer 2010; Safran Foer 2010; Albert Schweitzer Stiftung 2011).

According to these findings in Table 1 a list of indicators is presented. Indicators are taken from the Methodological sheets, the GRI criteria and the PROSA report complemented by the authors of this study's own indicators. Relevant midpoint impacts are allocated to the indicators based on the definitions in section 2.

4.2. Stakeholder group local community

Local communities are affected in connection with the feedstuff production but also by pig farming and slaughter. The already mentioned soy production in South America is heavily impacting local communities through land use, relocations, land grabbing and health effects caused by pesticides (UNFPA 2001; Casson 2003; PAN 2010; Fritz 2011). In addition, feedstuff production is affecting local communities through the pollution of groundwater (Anderson and Sobsey 2006). Complaints partly are noted regarding odor caused by manure used for fertilizing.

The pig farming itself impacts local communities by noise and odor (e.g. through ammonia emissions) and the potential loss of work places, which causes at least in Germany, waves of protest against industrial farm projects (BUND 2013). Additional factors are health effects, caused by emissions (e.g. ammonia, antibiotics, sulfurous substances and bacteria) from accruing manure (Wing and Wolf 2000; Nimmermark 2004; Walker et al. 2007; European Commission 2011).

Problems occurring in the neighborhood of slaughterhouses⁷ are high traffic volumes and related noise impacts, but also groundwater pollution with pathogenic agents, fats and excrements (Johns 1996; BMLF 1999).

Indicators addressing these impacts can be taken from Table 2. They are connected to relevant midpoint impacts. Indicators are taken from the Methodological sheets complemented by the authors' own developments.

⁵ Methicillin-resistant *Staphylococcus aureus*

⁶ As part of the study different pig farmers in Germany have been interviewed.

⁷ Nowadays slaughterhouses are mostly highly efficient and highly industrialized operating units with a high number of animals killed per hour.

Table 1: Indicator selection for the stakeholder group workers divided in general, feedstuff production, pig farming and pig slaughter indicators, complemented by new indicators and allocated to relevant midpoint impacts

Worker		
	Indicators	Impacts ¹
General indicators	Existence of labor laws per organization, sector and country ^a	WC, H&S, FW
	Potential of country/organization not passing labor laws ^b	WC, H&S, FW
	Violations of obligations to workers under labor or social security laws and employment regulations ^b	HR, WC, H&S, FW
	Freedom to join unions and to perform collective bargaining ^b	HR, WC
	Existence of transparent wage systems ^c	WC, FW
	Highest/lowest wage paid per organization, sector and country ^b	WC, FW
	Minimum and non-poverty wages per organization, sector and country ^b	WC, FW
	Duration and way of continued pay in case of sickness ^c	WC, FW
	Existence of contracts for work and labor ^a	WC
	Existence of regulations of working hours and overtime arrangements ^b	WC
	Compliance of legal recovery times ^a	WC
	Cases of discrimination and actions taken per organization, sector and country ^d	HR, WC, SER
	Ratio of basic salary of men to women by employee category ^d	HR, WC, FW, SER
	Accidents per organization, sector and country ^b	H&S
	Injuries, occupational diseases and lost days per organization, sector and country ^d	H&S
	Social benefits provided to the workers (e.g. health insurance, pension fund, child care, education, etc.) ^b	WC
	Existence and cases of child labor per organization, sector and country ^{b,c}	HR, WC, SER, E
Existence and cases of forced labor per organization, sector and country ^{b,c}	HR, WC, SER, E	
Feedstuff production	Health effects due to pesticide use per organization, sector and country ^a	H&S
	Prevalence of racial discrimination per organization, sector and country ^b	HR, SER
	Indigenous land rights conflicts/land claims ^{a,b}	HR, SER
Pig farming	Indebtedness per organization, sector and country ^a	WC, SER
	Excessive working hours per organization, sector and country ^b	WC, H&S
	Occurrence of chronicle diseases per organization, sector and country ^a	H&S
	Health effects due to (resistant) germs per organization, sector and country ^a	H&S
Pig slaughter	Number of slaughtered animals per hour and worker per organization, sector and country ^a	WC
	Psychological health effects per organization, sector and country ^a	H&S

¹ Midpoint impact categories allocated to the defined indicators according to Benoît et al. (2013) and Neugebauer et al. (2014); see section 2 – found to be relevant for workers are human rights (HR), working condition (WD), health & safety (H&S), social-economic repercussions (SER), level of education (E) and fair wage (FW)

^a Developed indicators by the authors of this study

^b Indicators taken from the Methodological sheets of SLCA (Benoît et al. 2013)

^c Indicators taken from the Product sustainability assessment guidance (Grießhammer et al. 2007)

^d Indicators taken from the Global Reporting Initiative (Global Reporting Initiative 2013)

Table 2: Indicator selection for the stakeholder group local community divided in general, feedstuff production, pig farming and pig slaughter indicators, complemented by new indicators and allocated to relevant midpoint impacts

Local community		
	Indicators	Impacts ¹
General indicators	Changes in land ownership ^b	HR, SER
	Use of abiotic and biotic resources and water per sector, area and country ^{a,b}	SER
	Prevalence of conflicts based on resource use per sector, area and country ^b	SER, H&S
	Freedom of expression and protest per sector, area and country ^b	HR, SER
	Relocations of persons per sector, area and country ^b	HR, SER
	Protection of cultural heritage per sector, area and country ^b	SER
	Health effects and diseases per sector, area and country ^b	H&S
Feedstuff production	Health effects due to pesticide use per sector, area and country ^a	H&S
	Pollution of water and groundwater due to pesticides per sector, area and country ^a	H&S, SER
	Prevalence of racial discrimination per sector, area and country ^b	HR, SER
	Indigenous land rights conflicts/land claims per sector, area and country ^{a,b}	HR, SER
Pig farming	Pollution of water and groundwater due to (resistant) germs per sector, area and country ^a	H&S, SER
	Occurrence of chronicle health effects per sector, area and country ^a	H&S, SER
	Increase in noise and odor per sector, area and country ^a	SER, H&S
	Health effects due to (resistant) germs per sector, area and country ^a	H&S, SER
Pig slaughter	Pollution of water and ground water per sector, area and country ^a	HR, SER, H&S
	Increase in traffic, noise and odor per sector, area and country ^a	SER, H&S

¹ Midpoint impact categories allocated to the defined indicators according to Benoît et al. (2013) and Neugebauer et al. (2014); see section 2 – found to be relevant are human rights (HR), health & safety (H&S) and social-economic repercussions (SER)

^a Developed indicators by the authors of this study

^b Indicators taken from the Methodological sheets of SLCA (Benoît et al. 2013)

4.3. Stakeholder group consumers

Consumers are affected by the final product pork, which per se does not cause negative effects. However, health effects are becoming more relevant, when considering the societal background and the overconsumption of meat in western societies. This overconsumption correlates with common civilization diseases like cardiovascular diseases, diabetes mellitus and some cancers (Walker et al. 2007; McMichael et al. 2007). Further, risks have been determined in connection with the use of antibiotics in animal farming and resulting resistances of bacteria and health effects on the consumer side (Böckel 2008; European Commission 2011; BfR 2014). Open questions remain in connection with genetically modified feedstuff (e.g. soy beans) and possible health effects. With this regard, information provided about the product by the producer to the consumer is clearly lacking. More research is needed, as no valid data are available, yet.

Relevant indicators can be taken from Table 3. Indicator sources are the Methodological sheets and the PRO-SA report complemented by own developments. The indicators are allocated to relevant midpoint impacts.

Table 3: Indicator selection for the stakeholder group consumer divided in general and pork consumption indicators, according to the analyzed effects, complemented by new indicators and allocated to relevant midpoint impacts defined

Consumer		
	Indicators	Impacts ¹
General indicators	Complaints of consumers per organization, sector and country ^b	SER
	Amount of information on/about the product ^b	SER, H&S
	Presence of law/norm regarding product's transparency per organization, sector and country ^b	SER, H&S
	Results from hygiene and quality checks per product, organization, sector and country ^a	H&S
	Health effects and diseases resulting from the products use ^{a,c}	H&S
Pork consumption	Labelling and transparency regarding genetically modified products within the supply chain ^a	(HR), H&S, SER
	Information about a balanced diet per sector and country ^a	H&S, E
	Occurrence of civilization diseases resulting from products use ^a	H&S
	Health effects due to (resistant) germs resulting from products use ^a	H&S

¹ Midpoint impact categories allocated to the defined indicators according to Benoît et al. (2013) and Neugebauer et al. (2014); see section 2 – found to be relevant are human rights (HR), health & safety (H&S), social-economic repercussions (SER) and level of education (E)

^a Developed indicators by the authors of this study

^b Indicators taken from the Methodological sheets of SLCA (Benoît et al. 2013)

^c Indicators taken from the Product sustainability assessment guidance (Grießhammer et al. 2007)

4.4. Animals and assignment within SLCA

Animals are impacted during the processes of pig farming and the slaughter at the end of the value chain. During the farming process the pigs are constantly restricted in their natural behavior⁸, due to limited space (e.g. limitations in lying down, in sexual behavior or piglets nursing) and abilities in connection with livestock density (e.g. limitations for cooling, like mud bathing). Further various psychological and physical health impacts are often observed, e.g. digestive diseases, skin and claw injuries and behavioral disorders, expressed in aggressions against other animals (LAVES 2010; Rutherford et al. 2011; Albert Schweitzer Stiftung 2013). Therefore the curly tails and canine teeth are cut, which mostly happens without any anesthesia. Existing laws for animal protection do not see any contradiction with common animal welfare principles, as long as it happens before a certain age of the piglets (BMJV 2013). The same accounts for the castration of male piglets. In addition, due to the high number of animals in a limited space the risk of epidemics is increased (BMJV 2013).

Further, animals are heavily affected by the transportation to the slaughterhouses and the pre-slaughter stopover. The fact that the animals will not survive this step in the product life cycle is neglected within this study, as the argumentation in favor of ending the animals life cannot be solved within SLCA and neither is there any consensus about a justification or right to kill animals for food reasons. However, the transportation of the animals involves a high level of stress often resulting in circulatory collapse or death. During the slaughter process failures in anesthesia occur on a regular basis. Further the broadly used CO₂ anesthesia causes additional stress through defensive reaction of suffocation (Provieh 2003; Wendt 2006; Puttrich 2012).

Indicators reflecting these impacts are included in Table 4. Included midpoint impacts are animal rights, which are seen as subordinated (see section 4), animal health and species specific repercussions.

⁸ Pigs have a distinctive social behavior, which is described in detail in (Hörning et al. 1999).

Table 4: Indicator selection for the stakeholder group animals divided in general, pig farming and pig slaughter indicators, according to the analyzed effects, allocated to relevant midpoint impacts defined

Animals		
	Indicators ^a	Impacts ¹
General indicators	Restrictions in species specific behavior (e.g. reproductive behavior, offspring nursing, social behavior etc.) per organization, sector and country	AR, AH, SSR
	Injuries and occupational diseases per organization, sector and country	AH
	Behavioral disorders per organization, sector and country	AH
	Health effects due to (resistant) germs per organization, sector and country	AH
	Mutilations performed per organization, sector and country	AR, AH
	Fattening period compared to natural live expectation	AR
	Genetic descent per organization, sector and country	SSR
	Freedom of hunger, thirst and pain	AR, AH
	Quality, dimension and hygiene of stables per organization, sector and country	AH
	Livestock density per organization, sector and country	AR, AH
Pig farming	Occurrence of death, injuries and behavioral disorders due to farming practice per organization, sector and country	AR, AH
	Distance and means of transport of piglets to the fattening farm per organization, sector and country	AH
Pig slaughter	Distance and means of transport to the slaughterhouse per organization, sector and country	AH
	Occurrence of injuries, fear and failure in anesthesia during the slaughter process	AH
	Guarantee of a painless and quick death	AR

¹ Midpoint impact categories allocated to the defined indicators; inspired by the already defined midpoint impacts according to Benoît et al. (2013) the following midpoint impacts for animals are defined: animal rights (AR), animal health (AH) and species specific repercussions (SSR)

^a All indicators are developed by the authors of this study.

The assignment of animals within SLCA is not straightforward, as no stakeholder group exists to represent animals' well-being. The Guidelines of SLCA define stakeholder groups as "a cluster of stakeholders that are expected to have shared interests due to their similar relationship to the investigated product systems" (Benoit and Mazijn 2009). According to Freeman (2010) a stakeholder is any group or individual who can affect or is affected by a certain action. Even if both sources originally focused on human beings, animals could be defined as a group of individuals affected by livestock farming processes, which shared interests due to their similar relationship to the product. However, the inclusion of animals within an own stakeholder group may cause inconsistencies with existing stakeholder groups, as e.g. children are also not defined as an own group, but as a subcategory. Further, animals cannot advocate for their own concerns and thus would need representatives (e.g. NGOs) to fight for their rights. The inclusion in existing stakeholder groups causes some shortcomings and difficulties as well. However, two groups seem reasonable at first sight: consumers and workers. By including animals into the group consumers, the animals' interest is only represented through the consumers' judgment or value choice, contrary to e.g. child labor which is also represented in the stakeholder group workers. Thus, the risk of not representing animals' interest adequately is quite high. When including animals as a subcategory into the stakeholder group workers, problems occur, as animals are not workers per definition. Since the stakeholder group society only covers societal impacts of organizations, animals cannot be represented within this group, even though industrial farming could indirectly harm the ethical values of society. As a consequence, further research is needed to define a proper place for the inclusion of animals' well-being within the stakeholder concept of SLCA. Until this issue is resolved, the proposed indicators should be used as an additional set of indicators independent from a particular stakeholder group.

5. Discussion

The presented indicator sets for animals and the three stakeholder groups reflect the life cycle of pork production. However, the indicators listed do not raise a claim of completeness, but rather address common hotspots within the supply chain. The same accounts for the considered midpoint impacts. In addition, impact pathways including characterization factors are not part of this study.

For the first time animals are included into SLCA, but animal rights and the treatment of animals is still under discussion. Thus, one might say that animals cannot be equated with the defined stakeholder groups. The proposal within this study is rather targeting the general inclusion of animals into SLCA, than to start discussions about the equality between different stakeholder groups or subcategories. However, more research is needed to solve the assignment problem of animals in connection with the existing SLCA framework.

Further, some stakeholder groups are not considered in SLCA in general or within this study, e.g. future generations. According to Klöpffer (2008) the inclusion of future generations is of importance for sustainability assessment. Agricultural activities in relation with animal farming are not unlikely to affect future generations by overusing abiotic resources like soil and water. Therefore it is recommended to address future generations within SLCA in foreseeable time.

6. Conclusion

The proposed set of indicators can serve as a starting point for SLCA studies of meat production and the inclusion of animal well-being in current assessment practice. Based on the indicator selection in connection with the affected midpoint impacts the logical next step would be the practical implementation into SLCA case studies. Adaptations are probably necessary and further indicators are possibly needed. However, the provided set of indicators serves as a first step towards the implementation of social aspects for meat production chains especially for the production of pork into SLCA. In addition for the first time impacts on animal's life are considered within SLCA.

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