

**SOCIAL AND POSITIVE SUSTAINABILITY PERFORMANCE
MEASUREMENT: THEORIES, CONCEPTUAL FRAMEWORKS, AND
EMPIRICAL INSIGHTS**

As dissertation presented by

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List of abbreviations

CDP	Carbon Disclosure Project
CO ₂	Carbon dioxide
CSP	Corporate social performance
CSR	Corporate social responsibility
DALY	Disability adjusted life years
EBSCO	Elton Bryson Stephens Company
ELCA	Environmental life cycle assessment
GRI	Global Reporting Initiative
IE	Industrial ecology
IP	Interview partner
ISO	International Standardization Organization
LCA	Life cycle assessment
LCC	Life cycle costing
LCSA	Life cycle sustainability assessment
MV	Mean value
NAICS	North American Industry Classification System
OECD	Organisation for Economic Co-operation and Development
PSP	Positive sustainability performance
PSPM	Positive sustainability performance measurement
RBV	Resource based view
RSPO	Roundtable on Sustainable Palm Oil
S&P 500	Standard & Poor's 500

SA8000	Social Accountability 8000
SAI	Social Accountability International
SASB	Sustainability Accounting Standards Board
SD	Standard deviation
SDGs	Sustainable development goals
SETAC	Society of Environmental Toxicology and Chemistry
SLCA	Social life cycle assessment
STXE 600	Stoxx Europe 600
TBL	Triple bottom line
TSC	The Sustainability Consortium
UN	United Nations
UNEP	United Nations Environment Programme
WCED	World Commission on Environment and Development

1. Introduction and motivation of the dissertation

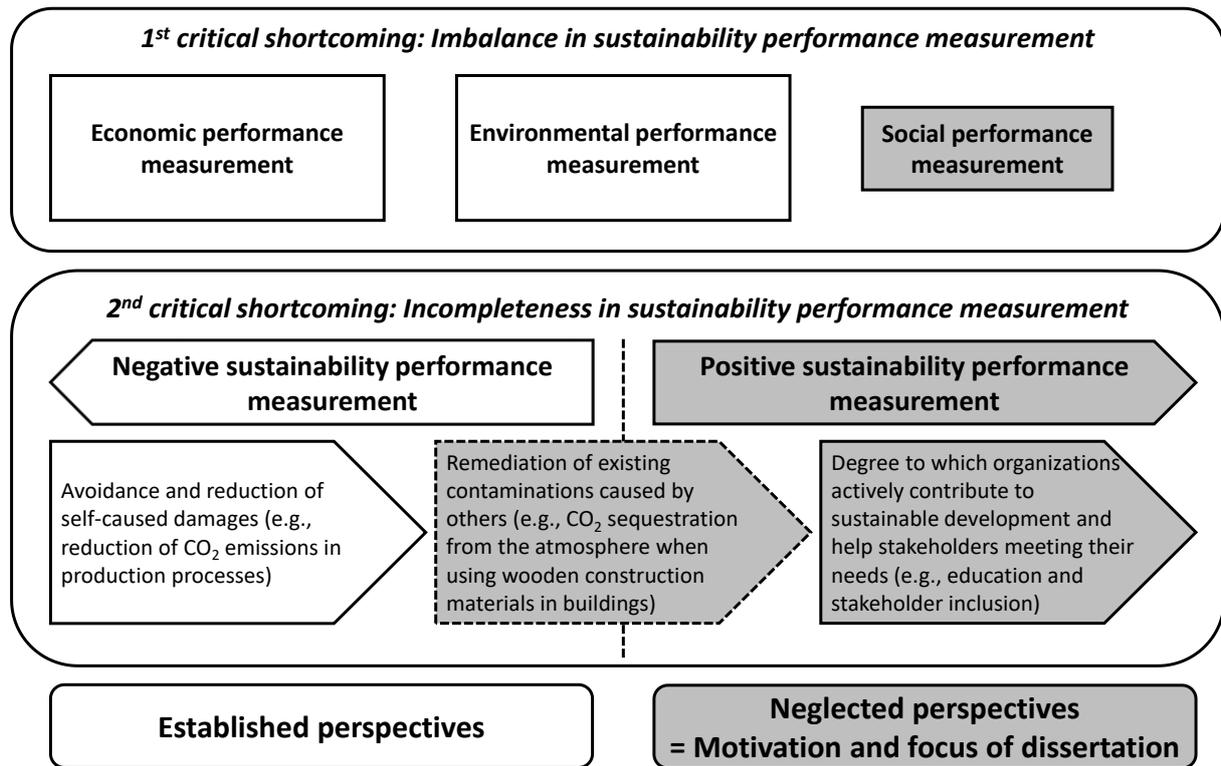
30 years have passed since the World Commission on Environment and Development (WCED) published its famous Brundtland report including its definition of sustainable development (WCED, 1987). Since then, sustainability performance measurement looking beyond traditional financial performance measurement is becoming increasingly important in academia, business practice, and regulation to assess and ultimately manage economic, ecological, and social benefits and damages of organizational behavior along corporate supply chains and product life cycles (e.g., Blass & Corbett, 2017; DeNisi & Smith, 2014; Richard, Devinney, Yip, & Johnson, 2009). Maas, Schaltegger, and Crutzen (2016b) characterize sustainability performance measurement as a process of collecting, analyzing, and communicating information about sustainability impacts to support internal management decisions in terms of improving the interactions between business, society, and the environment. Central to sustainability performance measurement is the use of performance indicators to capture and consolidate information (Lamberton, 2005; Schöggl, Fritz, & Baumgartner, 2016). However, two overarching critical shortcomings prevent sustainability performance measurement from becoming a truly holistic and relevant decision-supporting instrument.

First, the field is characterized by differing levels of maturity in terms of measuring performance of the three triple bottom line sustainability dimensions. Unlike established approaches for measuring ecological performance (e.g., with environmental life cycle assessment; ELCA) and economic performance (e.g., with life cycle costing; LCC), measuring social performance (e.g., with social life cycle assessment; SLCA) is still at a developmental stage (Corona, Bozhilova-Kisheva, Olsen, & San Miguel, 2017), because the field is understudied (Schöggl et al., 2016) and fragmented (Arcese, Lucchetti, Massa, & Valente,

2016), and lacks empirical experience (Baumann, Arvidsson, Tong, & Wang, 2013). Thus, the field of sustainability performance measurement is imbalanced in terms of the integrated assessment of the three sustainability dimensions.

Second, the field is characterized by a negative perspective and a focus on becoming less unsustainable instead of making positive progress to sustainable development. Current sustainability performance measurement approaches primarily assess negative burdens or footprints and their reduction during product life cycles and in supply chains (e.g., accidents and fatalities, carbon dioxide emissions, or total cost of ownership) and neglect capturing positive benefits occurring throughout product life cycles and corporate supply chains (Schaubroeck & Rugani, 2017). A critical reason is that research lacks a fundamental understanding of the general construct of positive sustainability performance (PSP). For example, Minor and Morgan (2011) argue that PSP results from avoiding or reducing self-caused negative and unsustainable issues or footprints, whereas Ridsdale and Noble (2016) consider the remediation and restoration of contaminations caused externally by others as positive. Alternatively, Kroeger and Weber (2015) consider PSP as the degree to which organizations actively benefit society and help stakeholders meeting their needs. Thus, the field of sustainability performance measurement is incomplete because it fails to characterize and assess the important positive perspective of sustainability-related value creation and positive contributions to sustainable development. Figure 1 illustrates the two overarching critical shortcomings of imbalance and incompleteness in the field of sustainability performance measurement.

Figure 1. Overview of overarching critical shortcomings in the field of sustainability performance measurement



Triggered by the overarching critical shortcomings, this dissertation aims at advancing the level of maturity of social performance measurement and at advancing the understanding of positive sustainability performance measurement to promote a more balanced and complete assessment of contributions to sustainable development. To achieve these overarching aims, this dissertation builds on a multitude of research methods (especially, systematic reviews of research and corporate practice, an extensive Delphi study, and qualitative interviews), a resulting richness of empirical data, and various theoretical reflections. In the remainder of the introductory chapter, I first emphasize the specific deficits and problems that cause the overarching critical shortcomings of social and positive sustainability performance measurement in research and practice. Subsequently, I present the structure of my cumulative dissertation, explain the logical connection between the individual studies, and elaborate how the studies contribute to overcoming the deficits and problems in research and practice.

1.1. Deficits and problems in the interrelated fields of social and positive sustainability performance measurement

Sustainability performance measurement is imbalanced because the development of social performance measurement is considerably lagging behind the already established approaches of ecological and economic performance measurement. The scientific field has become fragmented without a standardized assessment approach or clear research direction (Arcese et al., 2016). Consequently, without clear guidance from academia, the implementation of social performance measurement in corporate practice is stalling (Martínez-Blanco, Lehmann, Chang, & Finkbeiner, 2015). Because of the lacking standardization of social performance measurement, users of the social information (i.e., decision-makers in business practice) invest time and money in incomparable and confusing assessment results which compromises the likelihood to find and implement socially responsible solutions (Weidema, 2014).

A critical reason is that current conceptualizations and frameworks of social performance measurement fail to establish consensus on the most important assessment categories and indicators to include. Only worker-related health and safety are considered as a consensual assessment category (e.g., Beske-Janssen et al., 2015; Jørgensen, Bocq, Nazarkina, & Hauschild, 2008; Macombe, Leskinen, Feschet, & Antikainen, 2013), whereas impacts on others stakeholders are often overlooked (Gualandris et al., 2015). The inability of existing sustainability frameworks to establish consensual social indicators results from the problem that they are often based on common sense instead of empirical experience (Baumann et al., 2013). Therefore, many social indicators such as child labor are highly ideological and may be perceived ambiguously in different cultural backgrounds (Jørgensen, Lai, & Hauschild, 2010). Due to the lacking standardization, social performance measurement is subject to considerable variations resulting from influencing factors such as firms' sustainability orientation, stakeholders' expectations and salience, the location of operations, and the industrial sector

(Boukherroub et al., 2015; Gualandris et al., 2015). Therefore, researchers often use different and non-equivalent indicators that they subjectively believe are most relevant. Consequently, scholars looking to compare social performance of organizations or their products face unreliable results (Hassini, Surti, & Searcy, 2012). Therefore, they cannot arrive at abstract formulations of theoretical and conceptual (social performance) constructs (Price, 1972) so that social performance measurement still suffers from severe problems of validity, reliability, and generalizability (Croes & Vermeulen, 2015; Maas et al., 2016b; Rowley & Berman, 2000).

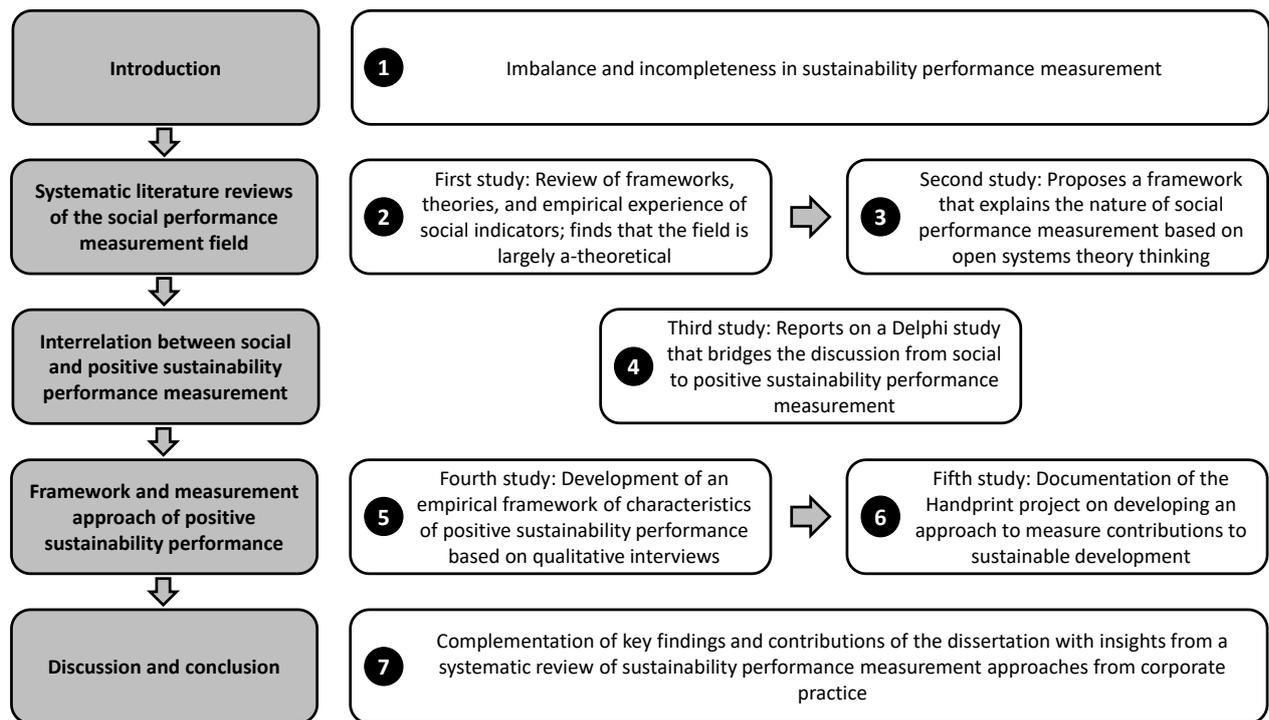
In addition to the lagging development and lacking standardization of social performance measurement (causing an imbalance in terms of the integrated assessment of the three sustainability dimensions.), the field is also incomplete because of its typical negative “paradigm that mankind damages the environment” (Schaubroeck & Rugani, 2017, p. 8). A reason for the established negative perspective in research, business practice, and regulation is that decision-makers have the habit of assuming that the key question when facing trade-offs (e.g., weighing jobs in the fossil energy sector against the ecological benefits of renewable energy, or benefits of the present generation against opportunities of future generations) is: Which side to favor to mitigate adverse effects to a point of acceptability (Gibson, 2013)? However, decision-makers rarely evaluate trade-offs with adequate care about the interdependencies of sustainability because mitigating adverse effects is important but insufficient by itself to deliver the needed transition to a more sustainable future (Gibson, 2013). Therefore, sustainability performance measurement also needs to “cover the other side of the coin” (Schaubroeck & Rugani, 2017, p. 8) of how human and industrial systems provide benefits to nature and human well-being, and thus, support decision-makers in recognizing and realizing win-win opportunities for business and society (Beske-Janssen et al., 2015; Kroeger & Weber, 2015; Lyneis & Sterman, 2016).

Although only few researchers marginally pick up the idea of a positive perspective in sustainability performance measurement, they point to problems similar to the issues in the field of social performance measurement. For example, Hacking and Guthrie (2008) conclude that establishing whether sustainability impacts are positive or negative is problematic, since they are not consistent across cultures, and involve subjective and dynamic value judgements. Consequently, Antolín-López, Delgado-Ceballos, and Montiel (2016) find inconsistencies in terms the positive and negative operationalization of sustainability indicators. Therefore, Di Cesare, Silveri, Sala, and Petti (2016) conclude that there is an urgent need for a clear and consensual definition of what constitutes the positive sustainability performance construct.

1.2. Structure and key contributions of the dissertation

This dissertation comprises five studies (i.e., two systematic literature reviews and three empirical papers based on multiple research methods and data sets). Together, the five studies highlight the trends, coherences, inconsistencies, and gaps in social and positive sustainability performance measurement. Furthermore, the studies establish and explain the interrelation between social and positive sustainability performance measurement, advance their conceptual and theoretical foundation, promote standardization by prioritizing relevant indicators, and suggest an approach to measure and evaluate positive contributions to sustainable development. After this introduction, each of the following five chapters represents one of my five studies. Subsequently, in the overarching discussion and conclusion chapter, I highlight and analyze my key findings and contributions, and complement them with insights from a systematic review of sustainability performance measurement approaches from corporate practice. Figure 2 illustrates the structure and logical connections between the individual chapters and studies, and highlights the multitude of research methods and data sets used. Next, I briefly outline the objectives of the following chapters and each study, and emphasize key contributions.

Figure 2. Structure of the dissertation



The first study titled “*Indicators in Social Life Cycle Assessment: A Review of Frameworks, Theories, and Empirical Experience*”¹ (chapter 2) provides a review of trends, coherences, inconsistencies, and gaps in research on social indicators across industry sectors to contribute to the maturation and establishment of the social pillar of sustainability performance measurement. Based on the conceptual background of industrial ecology and social life cycle assessment (SLCA), the study extends the scope of social performance measurement beyond the boundaries of the isolated organization to include impacts on multiple stakeholders’ social concerns during all stages of corporate supply chains and product life cycles (Blass & Corbett, 2017). To provide a systematic review of the literature, the study follows the research approach suggested by Denyer and Tranfield (2009) to identify and (deductively) analyze 141 papers of substantial relevance to SLCA indicators published up to the end of 2015.

¹ Published in the *Journal of Industrial Ecology* (double-blind and peer-reviewed): Kühnen, M., & Hahn, R. (2017). Indicators in social life cycle assessment: A review of frameworks, theories, and empirical experience. *Journal of Industrial Ecology*, 1–19. doi: 10.1111/jiec.12663.

Overall, the first study finds that researchers address a broad variety of sectors, but only few sectors receive sufficient empirical attention to draw reasonable conclusions. Therefore, as a step toward a more coherent understanding and standardization of social performance, the study contributes by synthesizing a minimum set of social indicators typically used in empirical research across industry sectors. Furthermore, the study highlights typical measurement approaches of SLCA indicators, the rationale for their inclusion, critical challenges in applying these indicators, and recommendation for their future development. Furthermore, the study emphasizes critical shortcomings in the SLCA field organized along the key phases of design, implementation, and evolution through which performance measurement approaches such as SLCA typically progress in their development and maturation. A critical shortcoming and key problem in the field is that researchers overlook important upstream and downstream consequences of organizational conduct. Such a focus on focal company performance points to a dearth of rigorous life cycle thinking in social performance measurement research. Therefore, the field still lacks a truly systemic industrial ecology orientation and largely neglects the “big picture” of social performance in life cycles and supply chains. A critical reason is that the majority of the sample is a-theoretical. Only a few researchers base their reasoning on an explicit theoretical reference point. This fragile theoretical base on which much social performance measurement research is resting triggered writing the second study of my dissertation.

Building on the same sample of 141 articles identified in the first systematic review paper, the second study titled “*Toward systemic social performance measurement: From a literature review to a conceptual framework*”² (chapter 3) systematically evaluates research on social indicators from an open systems theory perspective (e.g., Mitnick, 2000; Williams, Kennedy, Philipp, & Whiteman, 2017) and identifies trends and gaps. The second study argues that extant

² Resubmitted after revision to the Journal of Cleaner Production (single authored).

research lacks a systemic orientation in social performance measurement and proposes determinants explaining this shortcoming. Based on these propositions, the second paper provides a conceptual framework as a guide to future research. The framework adopts a systemic perspective for a holistic evaluation of social performance. In particular, my systemic framework explains how the interrelation of determinants in business organizations, supply chains, and the external system environment influences the often lacking (Croes & Vermeulen, 2015) comprehensiveness when assessing social performance along product life cycles and supply chains. Thus, my systemic framework helps to determine which social issues to measure and counters the weakness of existing frameworks of being more descriptive than analytic (Whitehead, 2017). The framework synthesizes my findings and propositions, thus providing theoretically grounded avenues for future research. Consequently, the value of the systemic framework in the second study lies in triggering a shift from primarily descriptive research toward theory development and consolidation (Touboulic & Walker, 2015) in social performance measurement research.

When conducting the systematic literature reviews, I realized that social performance measurement offers the opportunity to challenge and change established strategic decision-making patterns from the short-term profit rationale toward long-term progress of social responsibility and sustainable development. Therefore, the third study titled “*From SLCA to positive sustainability performance measurement: A two-tier Delphi study*”³ (chapter 4) elaborates on the intricate connection between social performance measurement and positive contributions to sustainable development captured by positive sustainability performance measurement (PSPM). Particularly, the third study argues that positive sustainability performance is likely to develop from the lens of social life cycle assessment (SLCA), because

³ Resubmitted after revision to the Journal of Industrial Ecology (co-authored with Prof. Dr. Rüdiger Hahn). I thank the organizers and participants of the “Hohenheim Revise and Resubmit Seminar in Management and Finance” for their invaluable feedback that substantially improved the study.

sustainability is an anthropocentric concept that puts positive benefits to human well-being (i.e., the social dimension of sustainability) at the center of the analysis (Schaubroeck & Rugani, 2017). However, analogous to the development of the now established field of positive psychology (Gillham & Seligman, 1999; Seligman & Csikszentmihalyi, 2000), sustainability performance measurement currently has a preoccupation with capturing and repairing negative dysfunctions and pathologies instead of fostering positive features that make a human life sustainable and worth living.

Therefore, the third study reports on an extensive Delphi study (Linstone, Turoff, & Helmer, 2002; Schmidt, 1997) with experts from academia and practice to foster a discussion of lessons learned from SLCA for PSPM. Thus, the study contributes to a more coherent and deeper understanding of both interrelated fields by discussion their core challenges and opportunities in the light of organizational functional effectiveness theory (e.g., Cunningham, 1977; Kroeger & Weber, 2015). Thus, the study consolidates the debate on SLCA and PSPM and provides a roadmap for future research. Overall, the results emphasize that SLCA has become a defensive risk management instrument against reputational damages, whereas PSPM offers the potential to proactively measure and manage positive contributions to sustainable development. However, the study also finds that the most fundamental barrier that impedes PSPM from reaching its full potential of becoming a decision-relevant instrument is the lack of a clear definition about the constituents and characteristics of positive sustainability performance (PSP).

To overcome this fundamental obstacle in the development of PSPM, the fourth study titled “*Characteristics of positive sustainability performance: A qualitative empirical framework*”⁴ (chapter 5) aims at establishing a universal understanding of the constituents and characteristics

⁴ The fourth study has a working paper status (single authored).

of PSP and, thus, builds the conceptual foundation for its future measurement and management. The fourth paper uses practice theory (e.g., Gram-Hanssen, 2010; Reckwitz, 2002; Schatzki, 1997) to analyze the practices and routines of actors along the entire life cycle of laundry detergents as a case study from the chemical manufacturing and consumer goods industry. The evidence in this study was collected by using semi-structured face-to-face interviews (Kvale, 2007). The main aim of the interviews was to obtain an in-depth understanding of the accounts given on the daily practices and routines performed by actors along the entire life cycle of laundry detergents. The perspectives obtained were used to develop an understanding of how the production and consumption of laundry detergents have a positive sustainability impact in peoples' subjective perception and experience. In the light of practice theory, the fourth study identifies and prioritizes a set of characteristics that constitute PSP and synthesizes an empirical qualitative framework. Thus, the study provides a first step toward a universal understanding of how industrial production and consumption contribute to sustainable development. Furthermore, it establishes a foundation for the future development of indicators assessing sustainable business practices that go beyond merely counteracting negative business outcomes toward actually delivering sustainability benefits for business and society.

To develop such a concrete PSPM approach, the fifth study titled “*Contributions to the sustainable development goals (SDGs) in life cycle sustainability assessment: Insights from the Handprint research project*”⁵ (chapter 6) presents the methodological development and empirical findings of the “Handprint” research project that aims at developing and testing a sustainability assessment approach to evaluate positive contributions to sustainable development at product level. The Handprint project builds on a multi-method approach involving systematic literature reviews, reviews of sustainability assessment approaches from

⁵ The fifth study has a working paper status (co-authored with Samanthi Luisa Silva, Prof. Dr. Rüdiger Hahn, Prof. Dr. Stefan Schaltegger, Dr. Ulrike Eberle, Marianne Schmid, Janpeter Beckmann, and Christoph Hermann).

corporate practice and external reference frameworks, iterative expert judgements from Delphi studies, participatory stakeholder workshops, and the application and testing of the Handprint approach in case studies.

Overall, the Handprint operationalizes how businesses and products contribute to achieving the United Nations' (UN) sustainable development goals (SDGs). However, the SDGs only provide vague, imprecise, and qualitative criteria to capture and evaluate contributions to sustainable development at organizational or product level (Verboven & Vanherck, 2016). To establish an evaluation approach that addresses the verbal fuzziness of the SDGs for business organizations and their products, the Handprint approach incorporates fuzzy set theory (Zadeh, 1965), because "it is particularly well suited as a bridge between natural language and formal models" (Zimmermann, 2010, p. 329). Overall, the fifth study documents the development a comprehensive and practically feasible approach for assessing the positive contribution of a product to sustainable development. Thus, it shifts the focus from reducing unsustainable, negative business practices to striving for positive contributions to sustainable development in sustainability assessment and management.

Finally, in the last chapter seven, I complement the overarching key findings and contributions of the dissertation with insights from a systematic review of sustainability performance measurement approaches from corporate practice.⁶ Based on this discussion, I provide overarching implications for research and practice to contribute to a more balanced and complete understanding of the interrelated fields of social and positive sustainability performance measurement.

⁶ This overarching discussion is partially based on the accepted conference submissions and presentations at the 75th Annual Meeting of the Academy of Management 2015 in Vancouver (Kühnen, M., & Hahn, R. 2015. Social indicators in corporate sustainability performance measurement. In *Academy of Management proceedings*, Vancouver. DOI: 10.5465/AMBPP.2015.12108abstract) and at the 36th Annual International Conference of the Strategic Management Society 2016 in Berlin (Kühnen, M., & Hahn, R. 2016. *Core issues in a systemic assessment of corporate social performance*. Paper presented at the 36th International Conference of the Strategic Management Society, Berlin).

2. First study: “Indicators in social life cycle assessment: A review of frameworks, theories, and empirical experience”⁷

Summary. Industrial ecology (IE) and life cycle sustainability assessment (LCSA) are increasingly important in research, regulation, and corporate practice. However, the assessment of the social pillar is still at a developmental stage, because social life cycle assessment (SLCA) is fragmented and lacks a foundation on empirical experience. A critical reason is the absence of general standardized indicators that clearly reflect and measure businesses’ social impact along product life cycles and supply chains. Therefore, we systematically review trends, coherences, inconsistencies, and gaps in research on SLCA indicators across industry sectors. Overall, we find that researchers address a broad variety of sectors, but only few sectors receive sufficient empirical attention to draw reasonable conclusions while the field is additionally still largely an a-theoretical one. Furthermore, researchers overlook important social core issues as they concentrate heavily on worker- and health-related indicators. Therefore, we synthesize the most important indicators used in research as a step toward standardization (including critical challenges in applying these indicators and recommendations for their future development), highlight important trends and gaps (e.g., the focus on worker- and health-related indicators and the a-theoretical nature of the SLCA literature), and emphasize critical shortcomings in the SLCA field organized along the key phases of design, implementation, and evolution through which performance measurement approaches such as SLCA typically progress in their development and maturation. With this, we contribute to the maturation and establishment of the social pillar of LCSA and IE.

⁷ Published in the *Journal of Industrial Ecology* (double-blind and peer-reviewed): Kühnen, M., & Hahn, R. (2017). Indicators in social life cycle assessment: A review of frameworks, theories, and empirical experience. *Journal of Industrial Ecology*, 1–19. doi: 10.1111/jiec.12663.

2.1. Introduction

Industrial ecology (IE) has become increasingly important in business and regulation. IE is the conceptual foundation for the development of approaches to life cycle sustainability assessment (LCSA) that business organizations and regulators need to systematically integrate to measure the ecological, economic, and social performance of products and organizational behavior (Blass & Corbett, 2017). However, unlike established approaches for measuring ecological and economic performance with environmental life cycle assessment (ELCA) and life cycle costing (LCC), social life cycle assessment (SLCA) is still in the development stage (Benoît et al., 2010; Martínez-Blanco et al., 2015; Salazar, Husted, & Biehl, 2012). Accordingly, SLCA remains a fragmented field (Arcese et al., 2016; Corona et al., 2017) that lacks empirical experience (Baumann et al., 2013). A critical reason is the absence of general standardized indicators⁸ that clearly reflect social performance (Kroeger & Weber, 2015; Traverso, Finkbeiner, Jørgensen, & Schneider, 2012; Zamagni, Masoni, Buttol, Raggi, & Buonamici, 2012). SLCA indicators provide short- and long-term information that helps organizations to better understand their current situation and their development over time (Lamberton, 2005). The use of social indicators can serve various decision-making functions, for example, benchmarking performance, tracking progress over time, assessing alternative processes to manufacture a given product (Ness, Urbel-Piirsalu, Anderberg, & Olsson, 2007; Schwarz, Beloff, & Beaver, 2002), monitoring supply chain performance (Hassini et al., 2012), and assessing product-related impacts on the wellbeing of stakeholders (Jørgensen, 2013).

Frameworks and assessment guidelines have been recently developed that emphasize the increasing importance of SLCA (e.g., published by the United Nations Environment

⁸ Since there is no overall accepted definition of the term “indicator” (Heink & Kowarik, 2010), we refer to the one in the Merriam-Webster dictionary, which characterizes an indicator as an instrument that shows the existence or condition of something (Merriam-Webster, 2016). We adapt this definition and characterize an indicator as a social indicator, if it shows the impact on or the condition of stakeholders’ wellbeing (separate from ecological impacts measured by environmental life cycle assessment).

Programme (UNEP) and Society of Environmental Toxicology and Chemistry (SETAC) 2009). However, researchers still emphasize the inability of existing frameworks to guide the selection of appropriate social indicators, as the selection is guided by common sense instead of empirical experience (Baumann et al., 2013). As a result, the indicators selected for social performance measurement often vary depending on factors such as firms' sustainability orientation, stakeholders' expectations and salience, the location of operations, and the industrial sector (Boukherroub et al., 2015; Gualandris et al., 2015). Owing to such inconsistencies, researchers often use different and non-equivalent indicators that they subjectively believe are most related to the theoretical and conceptual constructs (such as IE and LCSA) they want to investigate (Webb, 1974). Consequently, scholars looking to compare the performance of different supply chains and product life cycles face unreliable results (Hassini et al., 2012) and cannot arrive at abstract formulations of theoretical and conceptual constructs (Price, 1972). The development of general SLCA indicators, however, would facilitate standardization, which, in turn, promotes empirical experience and thus contributes to the development of the IE and LCSA constructs. From a practical perspective, in accordance with Weidema (2014), we argue that standardization (of social indicators) is needed to provide uniform rules and avoid unnecessary variation when conducting SLCA. Without standardization, the users of the social information (i.e., decision-makers) often pay for incomparable assessment results without any benefit. This generates costs for and confusion among information users, which reduce the likelihood to find and implement socially responsible solutions.

Following frequent calls for a more complete understanding and generalization of SLCA indicators (e.g., Corona et al., 2017; Shuaib et al., 2014; Traverso, Finkbeiner et al., 2012), our research questions are as follows: (1) What are the major trends, (in)consistencies, and gaps in research on SLCA indicators? (2) What implications for the selection of social indicators can be drawn from empirical experience in the field? By answering these research questions, we

take a step toward overcoming the problem of limited generalization and standardization of SLCA indicators and thus contribute to the maturation and establishment of the social pillar of LCSA. To achieve this aim, we provide a comprehensive overview of the use of concrete SLCA indicators in research and add to the few overviews of SLCA, which contain a general analysis of methodological issues on an abstract level (Macombe et al., 2013) or concentrate on isolated social indicators (Ahi & Searcy, 2015). Furthermore, we specifically investigate the level of empirical experience in research on SLCA across various industry sectors to analyze the (in)consistencies in the use of social indicators. Thus, we aim at contributing to the generalization and harmonization of SLCA which, in turn, is a requirement to achieve comparability of social performance at the levels of products, organizations, and supply chains (Eastwood & Haapala, 2015).

This paper is structured as follows. First, we illustrate the landscape of existing key frameworks related to social performance measurement and SLCA to establish an analytical grid for our investigation. Second, we describe our method of a systematic literature review, including its limitations. Third, we analyze the main descriptive results of the reviewed sample and provide a frequency analysis of the SLCA indicators used in research. Fourth, we discuss the development and application of SLCA indicators across industry sectors and thus synthesize the status quo of the empirical experience in research on SLCA indicators. Fifth, we synthesize and discuss critical shortcomings in extant research. Building on this synthesis, we provide avenues for future research. We conclude the paper by highlighting the main contributions.

2.2. Conceptual and theoretical background

From an IE perspective, a business organization interacts with its larger environment by providing inputs (e.g., physical substances, human and financial resources, or information) to a reconfiguration process and then emitting outputs into the organization's larger environment

(Hutchins & Sutherland, 2008; Wood, 2010). Jensen, Basson, and Leach (2011, p. 682) argue that IE should not be reduced to “a metaphor for environmentally benign industrial development” but should be studied as the ecology of human industry. Following this human perspective, IE should go beyond natural ecosystems and involve the social dimension of sustainability (Ehrenfeld, 2007). Thus, the input–reconfiguration and output–emission process is determined not only by the transformation of physical materials and energy but also by the generation of social harms and benefits related to that flow (Deutz & Ioppolo, 2015; Korhonen, 2007). Therefore, the IE perspective requires that the scope of social performance measurement extend beyond the boundaries of the isolated organization and include impacts on stakeholders’ social concerns during all stages of corporate supply chains and product life cycles with SLCA (Blass & Corbett, 2017; Isaksson, Johansson, & Fischer, 2010).

However, researchers frequently criticize the lack of consensus on the most important impact assessment categories and indicators to include in SLCA. To date, the conceptualizations and frameworks of social performance measurement tend to focus on impacts on worker-related health and safety as the only consensual assessment category (e.g., Beske-Janssen et al., 2015; Jørgensen et al., 2008; Macombe et al., 2013) and thus run the risk of overlooking impacts on multiple stakeholders (Gualandris et al., 2015). Furthermore, researchers question the ability of existing sustainability frameworks to guide the selection of consensual social indicators because these frameworks often lack a foundation in empirical experience (Baumann et al., 2013). They also fail to achieve consensus as they have limitations in assessing and measuring social and sustainability performance during life cycles and supply chains (Harik, Hachem, Medini, & Bernard, 2014).

For example, research on social and sustainability performance measurement sometimes refers to sustainability reporting frameworks (Beske-Janssen et al., 2015), such as the Global Reporting Initiative’s (GRI) G4 sustainability reporting guidelines (GRI, 2013) or the

Sustainability Accounting Standards Board's (SASB) standards (SASB, 2017). However, such reporting frameworks primarily aim at disclosing sustainability-related information through formalized means of communication (Hahn & Kühnen, 2013). Therefore, these frameworks do not focus on guiding internal performance measurement to support decision-making related to social sustainability. Another popular framework developed by the International Standardization Organization (ISO) is the guidance standard ISO 26000 (ISO, 2010) that aims to guide the integration of socially responsible behavior in an organization. However, ISO 26000 is not meant to be a management system standard and proposes only a snapshot of generic criteria for conducting assessments of organizational social performance (Hahn, 2013). Other than ISO 26000, the Social Accountability 8000 (SA8000) standard designed by Social Accountability International (SAI) is a certification standard that has to be audited by an independent organization and requires a certified firm and its upstream supply chain to respect and monitor social aspects (Sartor, Orzes, Di Mauro, Ebrahimpour, & Nassimbeni, 2016). However, SA8000 only has a limited life-cycle perspective because it is specifically related to the interests of upstream workers and ignores monitoring impacts on other downstream stakeholders.

Several institutions developed frameworks for social performance measurement and SLCA. For example, the Sustainability Consortium (TSC) develops product sustainability toolkits that identify potential impacts and prioritize hotspots and stakeholder issues throughout the entire life cycles of many consumer products (TSC, 2015). The toolkits contain key performance indicators developed in a multi-stakeholder process to assess the identified and prioritized hotspots (Benoît Norris et al., 2014). Further, the Roundtable for Product Social Metrics (2016) is a collaboration of private companies and external stakeholders coordinated by PRÉ Sustainability Consultants. Together, these organizations developed a handbook for assessing the social impact of products that aims at harmonizing practical and pragmatic impact

assessment principles, categories, and performance indicators (Fontes, Tarne, Traverso, & Bernstein, 2016).

Apart from these initiatives, the current main reference framework and “landmark in the field” (Corona et al., 2017, p. 2) are the UNEP and SETAC guidelines for SLCA of products (2009) and the methodological sheets for subcategories in SLCA (2013). The guidelines and methodological sheets are the foundation for frontrunner companies and other institutions, such as the Roundtable for Product Social Metrics, to develop their own methodologies (Fontes et al., 2016). Although not a standard, the SLCA guidelines adhere to the same major phases of ELCA (i.e., definition of goal and scope of the study, inventory analysis, impact assessment, and interpretation) as outlined in the ISO 14040 and 14044 standards (ISO, 2006). Thus, these guidelines offer a uniformed framework to increase knowledge, inform choices, and promote improvement in social conditions during product life cycles (Benoît et al., 2010). Although rapidly attracting interest in research to assess social impacts of various products (e.g., roses or laptop computers; Ekener-Petersen & Finnveden, 2013; Franze & Ciroth, 2011), the SLCA guidelines are still at the development stage, which has triggered various attempts to develop consensual SLCA and methodologies (e.g., social organizational LCA by Martínez-Blanco et al., 2015) and impact pathways between causes and effects of social indicators (e.g., Neugebauer et al., 2014). Therefore, the general scientific field has become fragmented (Arcese et al., 2016) without an established set of commonly accepted indicators to measure social performance (Andrews et al., 2009; Traverso, Finkbeiner et al., 2012; Zamagni et al., 2012).

Apart from critically examining the conceptual background of SLCA, some researchers call for more progress in providing the theoretical foundation of SLCA, especially regarding the impact categories and indicators chosen (e.g., Mathe, 2014; Reitingger, Dumke, Barosevcic, & Hillerbrand, 2011). We argue that SLCA is related to stakeholder theory (Freeman, 1984), because this assessment is an instrument for evaluating the social harms and benefits resulting

from company–stakeholder relationships during product life cycles. Freeman defines a stakeholder as “any group or individual who can affect or is affected by the achievement of the organization’s objectives” (1984, p. 46). To effectively capture and analyze the relationships between a business and its stakeholders, stakeholder theorists suggest that suitable indicators need to be developed that measure performance relative to the claims of stakeholders (e.g., Parmar et al., 2010). Correspondingly, the SLCA guidelines and methodological sheets categorize stakeholders into local communities, value chain actors, consumers, workers, and society and evaluate the social harms and benefits resulting from company–stakeholder relationships during product life cycles. Traditional management accounting approaches, such as balanced scorecards, struggle to factor in interactions with stakeholders during the life cycle, because these approaches often put the isolated business organization at the center of the analysis (Mitchell, Van Buren, Greenwood, & Freeman, 2015).

2.3. Method

Systematic literature reviews reveal trends, relationships, (in)consistencies, and gaps in the literature in order to organize, evaluate, and synthesize what is known and what is unknown in a particular field (Crossan & Apaydin, 2010). For our systematic review, we followed the approach suggested by Denyer and Tranfield (2009). We selected two major databases to ensure a broad coverage of the relevant field. We first searched the Social Science Citation Index given its extensive coverage of English-language peer-reviewed journals in business, management, and accounting. This database includes all journals with an impact factor, which are known to be the most important publications in the field. To extend our search, we additionally used the EBSCO Business Source Premier database. We conducted an extensive keyword search to find relevant articles published up to the end of 2015. A combination of anchor keywords and additional search strings developed through an iterative process of search and discussion between the two main investigators and other researchers enabled us to locate articles dealing

with the social dimension of sustainable organizational performance using the wildcards soci*, sustainab*, integrat*, responsib*, CSR, TBL, or “triple bottom line.” The anchor keywords were complemented by the keywords “life cycle” or “supply chain” to make sure we selected papers with an open systems orientation beyond organizational boundaries. Further, we added keywords targeting performance measurement and accounting, using the wildcards assess*, analy*, account*, quanti*, indicator*, index, indices, measur*, metric*, or criteria (Appendix I provides a detailed description and explanation of the specific search strings used as well as the resulting hits for each string and database). Overall, we identified 467 articles (excluding duplicates between search strings and databases) with our keyword search strings. We screened each article to assess whether its content was essentially relevant to social performance measurement in the business sphere. Only scholarly articles were considered; book reviews, news pieces, editorial notes, comments, etc. were excluded. To increase the reliability of the research findings, both authors checked each paper. In cases of differing opinions on content, a consensus was arrived at through discussion (Seuring & Gold, 2012). This process yielded 141 papers of substantial relevance to social indicators for life cycle-oriented performance measurement (see Appendix II for a complete listing of our review sample). All indicators that address social performance at product-level and at the level of organizational conduct of companies that comprise supply chains and product life cycles are considered as basic unit of analysis in each paper.

The next step was to analyze the material with a deductive approach. Deduction requires choosing ex ante an existing theoretical or conceptual framework as a lens for analyzing the data to arrive at a plausible generalization of findings (Seuring & Gold, 2012; Timmermans & Tavory, 2012). Employing this deductive logic in this research, we chose the subcategories developed for the SLCA guidelines (UNEP & SETAC, 2013) as the analytical lens since they are considered the “landmark in the field” (Corona et al., 2017, p. 2). Consequently, we

assigned the social indicators used in research to the SLCA subcategories. Furthermore, we assigned each individual paper to the industry sectors according to the North American Industry Classification System (NAICS; Office of Management and Budget, 2017) to allow for a fine-grained assessment of social indicators based on industry-patterns and to identify trends, coherences, inconsistencies, and gaps in the use of social indicators across various industries. By investigating how frequently the sector-specific articles address the SLCA subcategories, we evaluated the relevance of the subcategories and indicators for each of the NAICS sectors in empirical and non-empirical research.

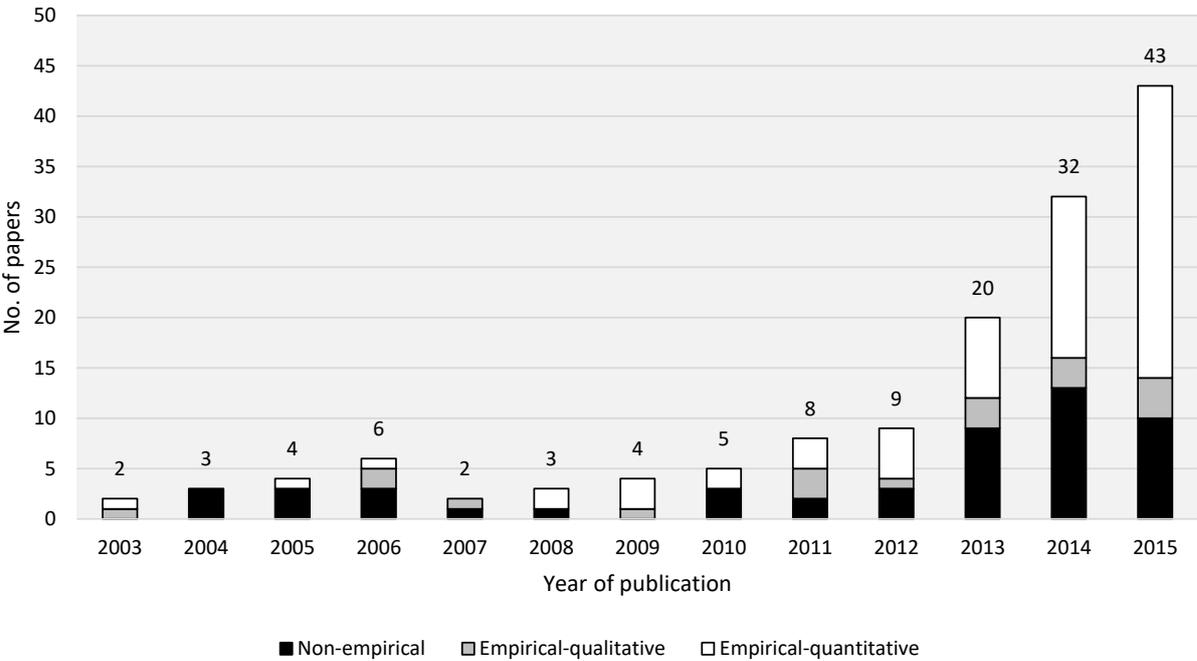
To ensure objectivity, we adhered to the structured approach described above. While the selection of the database may be considered a limitation, relying on two major databases yielded a broad range of articles. The databases selected also contributed to validity because of their extensive coverage of high-impact peer-reviewed journals (Podsakoff, MacKenzie, Bachrach, & Podsakoff, 2005). Our use of a rather complex combination of keywords in an attempt to find articles incorporating the social dimension of sustainability, performance measures, and life cycle thinking may also be regarded as a limitation. However, we consider this necessary because, from the IE perspective, simpler search terms yield an inferior selection of research papers. Reliability is addressed by including both authors in the analysis. Finally, although we aspire to achieve generalizable findings through an extensive search process covering the scientific field exhaustively, we do not claim that our findings can in fact be generalized beyond the reviewed sample.

2.4. Results

Consistent with Whiteman, Walker, and Perego (2013), we find that core management journals seldom publish research that combines social performance measurement with life cycle assessment. Ninety-one articles were published in journals related to business ethics or social,

environmental, and sustainability topics; 31 in journals from the area of production and operations; only two in journals from the accounting discipline; and another 17 in other specialty journals. Only five journals published five or more articles (*Journal of Cleaner Production* (21), *Sustainability* (16), *International Journal of Life Cycle Assessment* (15), *Supply Chain Management: An International Journal* (7), and *Journal of Business Ethics* (5)).⁹ Figure 3 illustrates the distribution of publications over time and the research methods used. Research on the integration of SLCA indicators in corporate performance measurement emerged at the beginning of the new millennium and continues to increase.

Figure 3. Distribution of the literature on SLCA over time and research approaches. SLCA = social life cycle assessment



Non-empirical (conceptual) articles account for approximately 37% of the reviewed literature. Of these, literature reviews (14 articles) provide only partial insights on social indicators, as they deal with more overarching concerns such as modeling approaches for

⁹ Our sample includes one paper published in *Journal of Industrial Ecology* (Baumann et al., 2013). Although many articles in the journal carried our search terms, they were nevertheless excluded when they did not address the (combination of the) social dimension of sustainability, performance measures, or life cycle thinking as a core topic.

sustainable supply chain management (e.g., Brandenburg, Govindan, Sarkis, & Seuring, 2014; Seuring, 2013) or isolated matters (Pizzirani, McLaren, & Seadon, 2014) and industries (Macombe et al., 2013). Other conceptual papers (37 articles) suggest, identify, or develop social indicators and often discuss their integration into a more holistic sustainability assessment framework along life cycles and supply chains.

Empirical studies account for approximately 63% of the reviewed literature sample. The relatively high number of quantitative studies, 71 in total (~50% of the sample), may point to the evolution in social performance measurement, progressing from a conceptual foundation to a quantitative application of social indicators. This development, however, can be discounted on the grounds of the comparatively low number of 19 qualitative studies (~13% of the sample), which has remained static from year to year. This is interesting considering that social issues are often of a qualitative nature and not easily quantifiable¹⁰. The comprehensiveness of social indicators in performance measurement can be questioned if important qualitative indicators are neglected in favor of more easily quantifiable issues. The neglect of qualitative research especially impedes the development of meaningful social indicators assessing stakeholders' subjective experience and perceptions of social impacts, which requires research methods such as in-depth interviews allowing an "insight into an individual's inner world" (Hopper & Powell, 1985, p. 431).

The overall increase in publications since 2011 may have been triggered by the publication of documents and frameworks for guiding social responsibility at the end of the first decade of the 2000s, from which 56 papers (about 40% of the sample) derive their social indicators. In particular, five main frameworks are frequently mentioned by researchers (with five or more references per framework: *GRI sustainability reporting guidelines* (20), *UNEP and SETAC*

¹⁰ Some environmental indicators might be qualitative as well, whereas other environmental (and social) issues are arguably easier than others to be accounted with quantitative figures.

SLCA guidelines and methodological sheets (18), UN millennium and sustainable development goals (7), Social Accountability International (SAI) SA 8000 (7), and ISO 26000 (5)). Table 1 shows the use of these five main frameworks in research along with the challenges and opportunities to illustrate the fitness for use of these frameworks in terms of measuring social performance.

Table 1. The use of the main frameworks in social performance measurement research

Framework	Articles referring to framework	Challenges and opportunities of framework in terms of social performance measurement
GRI sustainability reporting guidelines	Awaysheh and Klassen (2010); Basurko and Mesbahi (2014); Beske-Janssen, Johnson, and Schaltegger (2015); Boukherroub, Ruiz, Guinet, and Fondrevelle (2015); Brent, Heuberger, and Manzini (2005); Chardine-Baumann and Botta-Genoulaz (2014); Gauthier (2005); Gualandris, Klassen, Vachon, and Kalchschmidt (2015); Hutchins and Sutherland (2008); Labuschagne and Brent (2008); Labuschagne, Brent, and Claasen (2005); Mota, Gomes, Carvalho, and Barbosa-Povoa (2015); Pishvae, Razmi, and Torabi (2014); Rana and Misra (2010); Salvado, Azevedo, Matias, and Ferreira (2015); Schmidt et al. (2004); Seuring, Koplin, Behrens, and Schneidewind (2003); Stamford and Azapagic (2011); Varsei, Soosay, Fahimnia, and Sarkis (2014); Wu et al. (2015)	The GRI aims at providing organizations with a voluntary and globally shared framework of concepts, consistent language, and metrics to communicate clearly and openly about their sustainability performance. Hence, the GRI guidelines are more oriented towards organizational performance rather than systematic life cycle thinking. Furthermore, the GRI framework primarily aims at the disclosure of sustainability related information thus lacks a dedicated focus on guiding internal performance measurement to support decision-making.
UNEP and SETAC SLCA guidelines and methodological sheets	Aparcana and Salhofer (2013); Arcese, Lucchetti, and Merli (2013); Basurko and Mesbahi (2014); Baumann et al. (2013); Benoît-Norris, Norris, and Aullisio (2014); Chang, Ries, and Wang (2011); Feschet et al. (2013); Halog and Manik (2011); Jørgensen, Finkbeiner, Jørgensen, and Hauschild (2010); Lehmann, Russi, Bala, Finkbeiner, and Fullana-i-Palmer (2011); Lehmann, Zschieschang, Traverso, Finkbeiner, and Schebek (2013); Macombe et al. (2013); Martinez-Blanco et al. (2014); Meyer and Upadhyayula (2014); Papon, Itsubo, Malakul, and Shukuya (2015); Pishvae et al. (2014); Varsei et al. (2014); Wu et al. (2015)	The SLCA guidelines are complemented by methodological sheets that provide descriptions of 31 subcategories for SLCA structured according to five stakeholder groups. Each sheet includes a subcategory definition, examples of inventory indicators, units of measurement, and potential data sources. However, the guidelines and methodological sheets are not a standardized framework for SLCA and do not provide a consensual prioritization of impact categories and indicators. Nevertheless, they are considered as the current landmark in the field.
UN millennium and sustainable development goals	Ahi and Searcy (2015); Brent et al. (2005); Hutchins and Sutherland (2008); Labuschagne et al. (2005); Labuschagne and Brent (2008); Schmidt et al. (2004); Shokravi and Kurnia (2014)	The millennium and succeeding sustainable development goals represent consensual targets on a global scale and provide a potential normative foundation and reference point to capture positive contributions to sustainable development. However, the goals are not designed to evaluate contributions at organizational or product level.
SAI SA 8000	Awaysheh and Klassen (2010); Chardine-Baumann and Botta-Genoulaz (2014); Gualandris et al. (2015); Marshall, McCarthy, Heavey, and McGrath (2015); Miles and Munilla (2004); Pishvae et al. (2014); Varsei et al. (2014)	SA 8000 is a certifiable management system standard that sets basic requirements for workforce practices in internal and upstream supplier operations to protect human rights of workers. Hence, it is only cradle-to-gate oriented and ignores impacts on other stakeholders beyond workers.
ISO 26000	Awaysheh and Klassen (2010); Boukherroub et al. (2015); Chardine-Baumann and Botta-Genoulaz (2014); Gualandris et al. (2015); Pishvae et al. (2014)	Unlike SA 8000, the international guidance standard on social responsibility ISO 26000 is a non-certifiable guideline that assists organizations in implementing social responsibility in seven core subjects (beyond worker issues) that can be used as generic impact categories for conducting assessments of organizational social performance.

Note: SLCA = social life cycle assessment.

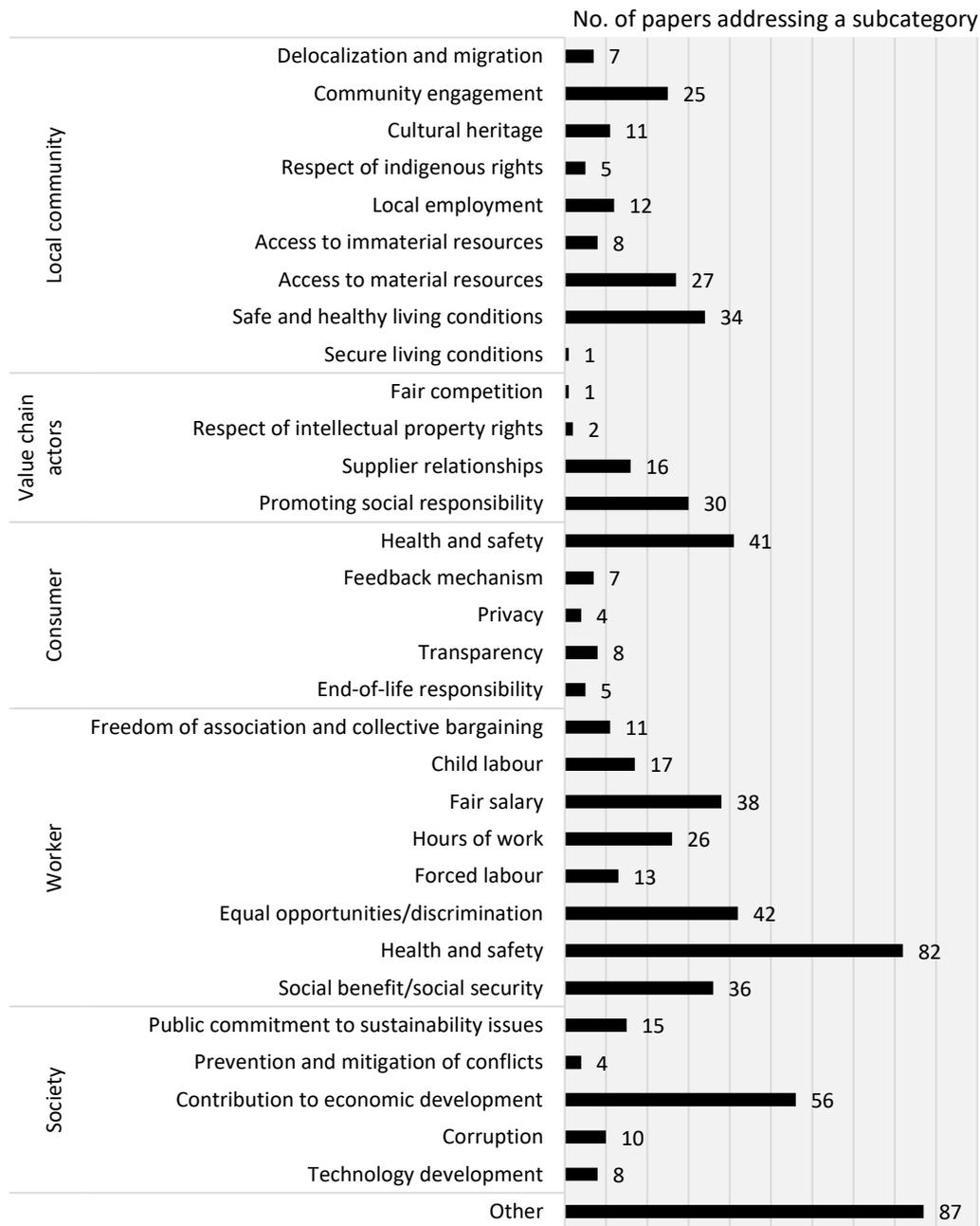
Most of the frameworks refer to performance from the triple bottom line (Elkington, 1997) perspective of sustainability. In terms of the three sustainability dimensions, most papers in the sample integrate social indicators *together* with ecological and/or economic indicators: Three papers (about 2% of the sample) contain indicators that aim at a socio-economic assessment and seven papers (about 5%) deal with a socio-environmental assessment. The majority of papers (103 papers; about 73%) even aims to integrate indicators of all three sustainability dimensions during life cycles and supply chains. At first sight, this points to the increasing importance and maturation toward a truly holistic LCSA. However, research with a more dedicated focus on social performance (only 28 papers; about 20% of the sample) might reveal interesting insights that are otherwise overlooked (Beske-Janssen et al., 2015). For example, Salvado et al. (2015) argue that the three dimensions of sustainability are most informative when they are analyzed separately before consensus on the operationalization of LCSA and especially SLCA indicators is achieved.

As the currently most suitable landmark framework in the field, the SLCA guidelines and methodological sheets allocate social indicators to a set of subcategories clustered into five stakeholder groups to evaluate social impacts. Thus, each social indicator in a paper was individually assigned to a single SLCA subcategory to provide a detailed picture of the trends and gaps in the academic assessment of company–stakeholder relationships during life cycles and supply chains. Figure 4 provides a detailed picture of the number of papers addressing a subcategory per stakeholder group. Workers are clearly the most salient (Mitchell, Agle, & Wood, 1997) stakeholder group addressed in research (104 papers; about 74% of the sample) with a particular focus on health and safety indicators when monitoring social performance. Moderate salience can be associated with local communities (69 papers; about 49% of the sample) and society (64 papers; about 45% of the sample). Again, researchers emphasize indicators of safe and healthy living conditions in local communities, whereas impacts on

society are assessed with indicators that capture the contribution to economic development. The least salient and often neglected stakeholder groups in extant research are consumers (48 papers; about 34% of the sample) and value chain actors (40 papers; about 28% of the sample). In terms of consumers, researchers again prioritize health and safety indicators. Regarding value chain actors, there is a focus on indicators that assess the promotion of social responsibility in the value chain.

Eighty-seven articles (about 62% of the sample) use indicators that address categories other than those from the SLCA guidelines and methodological sheets. These other categories include stakeholders' subjective perceptions (e.g., satisfaction), legitimacy and acceptance granted by society, product and service features (e.g., functional utility, quality, and affordability), animal welfare, philanthropy and charity, stakeholder engagement and participation, overall governance and management (e.g., stakeholder vs. shareholder orientation), compliance with regulation and standards, and intergenerational equity (e.g., long-term burdens such as climate change or radioactive waste). Thus, the SLCA subcategories might lack completeness because they do not include performance categories deemed important by a majority of research in this field. Excluding these other categories, on average, only four of the 31 SLCA subcategories are included per paper.

Figure 4. Overall distribution of papers addressing a subcategory per stakeholder group from the methodological sheets for SLCA (UNEP & SETAC, 2013)



Note that a single paper may address multiple subcategories per stakeholder group so that the numbers do not add up to the total number of papers. SLCA = social life cycle assessment.

Finally, our analysis revealed an unequal distribution of social indicators over the stakeholder groups and subcategories, which highlights the overall fragmented nature of SLCA research (Arcese et al., 2016). We conclude, in line with Burritt and Schaltegger (2014), that this might be because research on social performance measurement along corporate supply

chains and product life cycles is not based on well-founded theoretical literature and is thus largely a-theoretical. Only a few notable exceptions (24 papers; ~ 17% of the sample) elaborate their reasoning on social performance measurement with an explicit theoretical reference. Table 2 maps this scarce use of theory in the field to provide future researchers with an orientation and thus contribute to the advancement of the field.

Table 2. The use of theories in social performance measurement research

Theory	Articles referring to theory	Overall purpose of theory in terms of social performance measurement
Systems theory	Halog and Manik (2011); Hutchins and Sutherland (2008); Matos and Hall (2007); Onat, Kucukvar, and Tatari (2014); Papong et al. (2015); Sala et al. (2013b, 2013a), Salvado et al. (2015); Shih and Tseng (2014); Yu and Halog (2015)	Systemic constructs such as Industrial Ecology aim at understanding performance of the whole by analyzing the interactions between the elements or agents that compose the whole. Hence, from a systemic perspective, social indicators should capture important interactions between the different actors that compose the whole supply chain or product life cycle. Thus, systems theory helps analyzing the completeness of social performance measurement.
Stakeholder theory	Arcese et al. (2013); Gauthier (2005); Gualandris et al. (2015); Mathe (2014); Matos and Hall (2007); Morali and Searcy (2013); Seuring et al. (2003); Varsei et al. (2014)	Stakeholder (salience) theory argues, that the legitimacy of an organization or whole supply chain can be threatened by powerful stakeholders that use their own legitimacy to make claims that should be addressed urgently by a firm's supply chain. Thus, stakeholder salience can be instrumental to the implementation, scope and quality of social performance measurement.
Resource based view of the firm	Marshall et al. (2015); Morali and Searcy (2013); Varsei et al. (2014); Wiengarten and Longoni (2015)	The resource based view (RBV) argues that firms can achieve and sustain competitive advantage if they possess valuable, rare, non-imitable, and non-substitutable resources. Therefore, RBV emphasizes the need to create core competencies and capabilities (e.g., social performance measurement) to gain competitive advantage. Thus, RBV helps analyzing how firms can achieve sustainable competitive advantages through competencies and capabilities in social performance measurement.
Network theory	Halog and Manik (2011); Vachon and Mao (2008); Varsei et al. (2014)	Network theory models and visualizes a complex system as a network of interlinked organizations. It analyzes the structure of inter-organizational relations and how the position in a network influences organizational behavior. Thus, network theory helps understanding how the position in a network determines social performance measurement and inter-organizational decision-making.
Institutional theory	Morali and Searcy (2013); New (2015); Varsei et al. (2014)	Institutional theory argues that organizations seek survival and legitimacy by adapting their structure and behavior to isomorphic institutional rules stemming from coercive, mimetic, and normative pressures. Hence, institutional theory facilitates understanding how differing institutional settings determine the social performance measurement and how it helps organizations to assess their conformity to institutional rules.
Resource dependence theory	Morali and Searcy (2013); Wolf (2014)	Resource dependence theory argues that organizations seek control over resources to reduce their dependence on other organizations and to increase dependence of others on themselves. Consequently, firms engage in inter-organizational collaboration and relationship management to reduce uncertainty and increase power. Therefore, resource dependence theory helps analyzing how firms can reduce uncertainty by assessing social issues in supply chain relationships.
Transaction cost theory	Morali and Searcy (2013); Wiengarten and Longoni (2015); Zailani, Jeyaraman, Vengadasan, and Premkumar (2012)	Transaction costs include direct costs of managing relationships (to overcome information asymmetries) and potential opportunity costs resulting from poor decision-making along the supply chain. Therefore, it offers a perspective to understand how social performance measurement along the supply chain can support coordinative decision-making and thus improve transactional efficiency.
Governmentality theory	Spence and Rinaldi (2014)	Governmentality provides an analytical lens for examining the conditions, actions and mechanisms in organizations that determine ways of exercising power and authority. Thus, it allows to examine the role of social performance measurement in governing socially responsible behavior.

Theory-building efforts in social performance measurement are scarce, despite the growing number of empirical papers published. More and potentially surprising contributions can emerge from the adoption of original empirical methodologies (e.g., more qualitative research which seems underdeveloped in the field) and from testing and combining (underexplored and/or new) theoretical lenses. For example, a combination of stakeholder theory and systems theory could be a foundation when developing social impact pathways for SLCA. The systemic perspective can help understanding the causes and effects of the interactions between the stakeholders comprising the whole product system and thus support the modelling of relationships between descriptive and situational performance indicators (e.g., income) and actual consequences and impacts felt by stakeholders (e.g., changes in health status). To intensify the maturation of SLCA, future research can draw from the empirical experience of the field and move beyond a-theoretical and descriptive research toward theory development and consolidation (Touboulic & Walker, 2015). Therefore, the next section discusses the trends, (in)consistencies, and gaps in the non-empirical foundation and empirical experience of the field and synthesizes important SLCA indicators from empirical research across industry sectors.

2.5. Discussion the state of SLCA indicators across industry sectors

2.5.1. Trends and gaps in non-empirical and non-sector-related research

We continue in this critical review with an overview of the non-empirical foundation of research on SLCA indicators. Nineteen conceptual papers are not related to a specific industry sector and represent the conceptual foundation of the overall field. Several authors discuss what the overall concepts of LCSA and SLCA should look like to validly assess social and sustainability performance during product life cycles and supply chains (Burritt & Schaltegger, 2014; Heijungs, Huppes, & Guinée, 2010; Sala, Farioli, & Zamagni, 2013b, 2013a), and point

to the challenges of existing accounting approaches to achieve that aim (Metta & Badurdeen, 2013; Widomski, 2014). A specific and frequently mentioned challenge of the SLCA field is related to the need to define valid social impact categories (Jørgensen, Finkbeiner et al., 2010; Jørgensen, Lai et al., 2010) and corresponding indicators (Hutchins & Sutherland, 2008; Ingwersen et al., 2014; Miles & Munilla, 2004). Building on the discussion of categories and relevant indicators, some authors propose approaches to identify, select (Neugebauer, Martinez-Blanco, Scheumann, & Finkbeiner, 2015), quantify (Kim, Jeong, & Jung, 2014; Weidema, 2006), and aggregate (Shokravi & Kurnia, 2014) social and sustainability indicators (Chardine-Baumann & Botta-Genoulaz, 2014; Schmidt et al., 2004).

Overall, the conceptual research points to several critical gaps in SLCA that need to be addressed. They include the development of a valid and reliable selection process for the many existing social indicators, the development of better databases as existing databases address social performance only at the country or sector level, and the development of building impact pathways that bridge the gap between simply linking and aggregating social performance inventory indicators within a stakeholder group (type I characterization model) and actually establishing causal relationships between social activities that cause changes and effects resulting in impacts (type II characterization model; e.g., causality between organizational activities that cause economic development resulting in public health improvement; Feschet et al., 2013). Beyond such measurement and assessment-related issues, only two papers discuss how organizational determinants (including firm capabilities, stakeholder salience, and supply chain integration) hinder or enable the adoption and development of social performance measurement practice in life cycles and supply chains (Gualandris et al., 2015; Varsei et al., 2014). Therefore, research on factors that determine the adoption, development, and implementation, or the comprehensiveness and quality of social performance measurement is only rudimentary in extant literature.

Seven non-sector-related review papers summarize certain issues in the field. From an overarching perspective, a few papers review the literature in terms of the current state of concepts, instruments, footprint approaches (Beske-Janssen et al., 2015; Čuček, Klemeš, & Kravanja, 2012; Miemczyk, Johnsen, & Macquet, 2012; Ness et al., 2007), and quantitative models (Seuring, 2013) of sustainability performance in supply chains. Focusing on more specific performance categories, Ahi and Searcy (2015) identify supply chain performance metrics used in the literature that specifically address safety, welfare, and community-related issues, whereas Pizzirani et al. (2014) review how culture is incorporated into SLCA (e.g., as a reference line to conceive what is socially damaging or beneficial). Although these reviews agree that there is a noticeable trend of extending social performance measurement beyond single organizations to supply chains and product life cycles, the authors also conclude that the field remains at the developmental stage because the social dimension is often missing, terminologically inconsistent, or overly simplified with generic measures instead of specific measurement units. Consequently, the authors emphasize the importance of agreeing at least on a small set of standardized indicators to promote comparability between value chains.

2.5.2. Trends and gaps in non-empirical and sector-related research

After this brief illustration of non-sector-related research, we provide an overview of the conceptual foundation in research across industry sectors. Here, thus far, researchers have concentrated on the manufacturing sector. Nine articles conceptually discuss the need to extend LCA with the social impacts of products, suggest indicator sets, develop hierarchical indicator prioritization, provide evaluations of aggregation approaches, and suggest overall methodological assessment procedures for electrical equipment, appliance, and component manufacturing (Chou, Chen, & Conley, 2015; Gauthier, 2005), chemical manufacturing (Dale et al., 2013; Halog & Manik, 2011), nonmetallic mineral product manufacturing (Devika, Jafarian, & Nourbakhsh, 2014; Hoogmartens, Van Passel, Van Acker, & Dubois, 2014), food

manufacturing (Maloni & Brown, 2006; Mann & Gazzarin, 2004), and multiple manufacturing (Benoît Norris et al., 2014) subsectors. Other less frequently addressed sectors in conceptual SLCA research include agricultural crop production (Feschet et al., 2013; New, 2015), construction of buildings (Lützkendorf & Lorenz, 2005), electric power generation, transmission, and distribution (Norris, 2006; Wood & Hertwich, 2013), scientific research and development services (Meyer & Upadhyayula, 2014), waste management and remediation services (Aparcana & Salhofer, 2013), and other multiple (Chen & Delmas, 2011; Labuschagne et al., 2005) sectors.

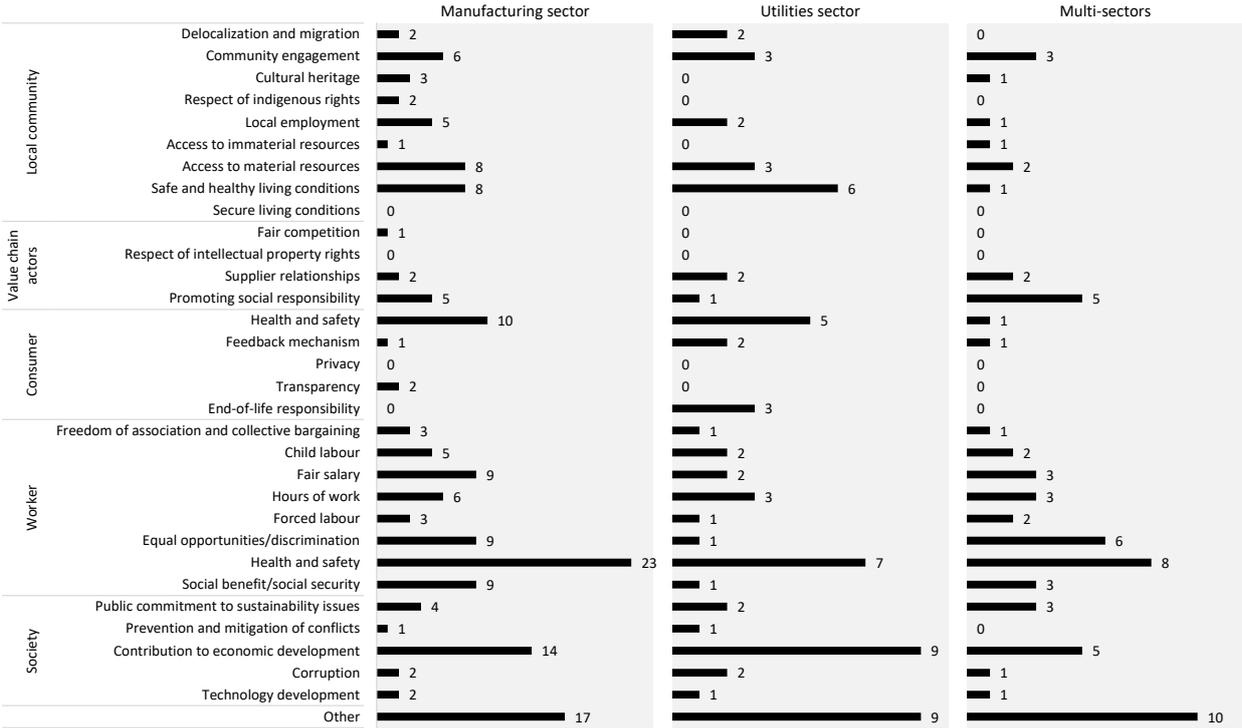
Finally, seven sector-related literature reviews present sustainability assessment approaches and models that apply sustainability indicators to heavy and civil engineering construction (Bueno, Vassallo, & Cheung, 2015), animal production and aquaculture (Samuel-Fitwi, Wuertz, Schroeder, & Schulz, 2012), food manufacturing (Springer et al., 2015), and other multiple sectors (Brandenburg et al., 2014; Brandenburg & Rebs, 2015; Tajbakhsh & Hassini, 2015a). However, only Macombe et al.'s (2013) review has a dedicated social focus on SLCA and social indicators in chemical manufacturing (biofuel production), whereas the other sector-related reviews focus on the overarching sustainability performance in each sector. Overall, in these non-empirical and sector-related articles, the authors conclude that it is not yet possible to conduct a comprehensive SLCA in various industry sectors because extant research is biased toward either an environmental or an economic assessment, neglecting certain stages of the life cycle (especially the use and end-of-life stages).

2.5.3. (In)consistencies and gaps in the empirical experience across industry sectors

After this brief illustration of the non-empirical foundation of research in SLCA indicators, we analyze the empirical experience with SLCA indicators across industry sectors. Overall research on SLCA indicators addresses a broad variety of industry sectors spanning agriculture, forestry, fishing, and hunting (seven papers), construction (six), transportation and warehousing

(five), mining, quarrying, and oil and gas extraction (three), accommodation and food services (two), retail trade (two), administrative and support and waste management and remediation services (one), and health care and social assistance (one). However, only a few sectors have received sufficiently deep empirical attention to draw reasonable conclusions in terms of the empirical experience in the field (Baumann et al., 2013) to overcome the problem of the limited generalized and standardized SLCA indicators. Only the manufacturing sector, utilities, and multi-sectors research generated ten or more articles, which we now discuss in detail (Figure 5 illustrates the SLCA subcategories addressed in empirical manufacturing, utilities, and multi-sectors research).

Figure 5. SLCA subcategories addressed in empirical manufacturing, utilities, and multi-sectors research



Note that the scaling of the numbers of papers differs between the sectors to illustrate and compare the relative frequencies of the subcategories addressed.

Empirical research on the manufacturing sector (32 papers) is diverse and investigates SLCA issues in various manufacturing subsectors. The most frequently addressed subsector is chemical manufacturing (Azadi, Jafarian, Farzipoor Saen, & Mirhedayatian, 2015; Colodel,

Kupfer, Barthel, & Albrecht, 2009; Kumar, Palaniappan, Kannan, & Shankar, 2014; Martinez-Blanco et al., 2014; Seuring et al., 2003; Taplin, Bent, & Aeron-Thomas, 2006). Especially fuels based on renewable resources have attracted substantial interest in research on chemical manufacturing. Several authors developed social indicator frameworks and empirically assessed the social impacts of hydrogen fuel production (Ren, Manzardo, Toniolo, & Scipioni, 2013) and biomass fuel production (Corbière-Nicollier, Blanc, & Erkman, 2011; Kudoh et al., 2015; Maroun & La Rovere, 2014; Ren, Manzardo, Mazzi, Zuliani, & Scipioni, 2015; Santibañez-Aguilar, González-Campos, Ponce-Ortega, Serna-González, & El-Halwagi, 2014). Other manufacturing subsectors have received significantly less attention in empirical SLCA research. Compared to the overall sample (see again Figure 4), the manufacturing sector resembles the distribution of SLCA subcategories with a heavy emphasis on worker health and safety and a significant neglect of value chain actors.

Empirical research on the utilities sector (12 papers) primarily aims at comparing social impact scenarios of electric power generation, transmission, and distribution through renewable (Ahmad & Tahar, 2014; Delivand, Barz, Gheewala, & Sajjakulnukit, 2012; Thornley et al., 2009; Yu & Halog, 2015), conventional (Shih & Tseng, 2014), and/or nuclear energy alternatives (Cartelle Barros, Lara Coira, De la Cruz López, María Pilar, & Del Caño Gochi, 2015; Klein & Whalley, 2015; Maxim, 2014; Santoyo-Castelazo & Azapagic, 2014; Stamford & Azapagic, 2011). The social impacts of water, sewage, and other systems are less frequently investigated in research related to utilities (Lehmann et al., 2013; Molinos-Senante, Gómez, Garrido-Baserba, Caballero, & Sala-Garrido, 2014). In comparison with the overall sample (see again Figure 4), the empirical experience of utilities shows notable deviations in terms of the SLCA subcategories addressed. In particular, there is a shift in stakeholder salience from workers to society as research on utilities emphasizes the importance of the contribution to

society's economic development. However, in agreement with the overall sample, research on utilities also neglects the assessment of social impacts on value chain actors.

Empirical multi-sector research (12 papers) covers almost all NAICS industry sectors (Burgess & Singh, 2006; Harms, Hansen, & Schaltegger, 2013; Labuschagne & Brent, 2008; Lehmann et al., 2011; Marshall et al., 2015; Matos & Hall, 2007; Morali & Searcy, 2013; Papong et al., 2015; Rana & Misra, 2010; Simas, Golsteijn, Huijbregts, Wood, & Hertwich, 2014; Tajbakhsh & Hassini, 2015b; Wolf, 2014). Only two NAICS industry sectors are not considered (management of companies and enterprises and arts, entertainment, and recreation). Compared with the overall sample (see again Figure 4), empirical multi-sector research emphasizes the salience of worker interests over other stakeholder groups. In particular, multi-sector research neglects the SLCA subcategories related to consumers, whereas research on manufacturing and utilities uses indicators that address (at least) consumer health and safety.

2.5.4. Synthetization of social indicators from empirical research across industry sectors

The stakeholder perspective in SLCA and performance measurement imply that stakeholders experience the social impacts of corporate activities in life cycles and supply chains (Corona et al., 2017; Wood, 2010). Therefore, we analyze and prioritize the most frequently addressed SLCA subcategories per stakeholder group with the main corresponding social indicators across empirical manufacturing, utilities, and multi-sector research. We provide guidance for selecting the minimum set of the most important (generic, qualitative, and (semi)quantitative) social indicators to assess company–stakeholder relationships based on empirical experience (as Baumann et al., 2013 called for, in this journal) across industry sectors. We structure our analysis along the stakeholder groups suggested in the SLCA methodological sheets. Table 3 provides an overview of a set of the most important social indicators along with the rationale

for their inclusion, current shortcomings of applying them in practice, and recommendations for their future development.

Table 3. Overview of the most frequently addressed SLCA subcategories and indicators

Subcategories	Indicators	Typical measurement approaches in research	Rationale for inclusion, shortcomings, and recommendations
Safe and healthy living conditions in local communities	Potential of accident risks	Narrative description	<ul style="list-style-type: none"> - Consensus in research on importance of health and safety aspects in SLCA - Potential of accident risks aims at anticipation and prevention of future accidents - Local morbidity and human health depreciation aim at retrospective correction of business operations with negative health impacts on local community members - Extant research often only vaguely mentions potential of accident risks without specification of detailed qualitative assessment criteria - Causal ascription of local health damages to specific organizations and operations may be only limitedly possible
	Local morbidity & human health depreciation	DALY of local community members	Future research needs to elaborate anticipatory (qualitative) risk assessment criteria for preventing potential health and safety issues, and validate the importance of DALY as health impact assessment approach in SLCA.
Promoting social responsibility among value chain actors	Suppliers' compliance with human rights & codes of conduct	Verification on a semi-quantitative yes/no scale	<ul style="list-style-type: none"> - Indicators aim at promoting social responsibility by monitoring obligation of upstream and downstream value chain actors to respect basic human rights in their business operations and eventually take corrective actions
	Screening of suppliers & downstream contractors on human rights	Number & percentage of actors screened	<ul style="list-style-type: none"> - Complexity of many supply chains impedes an exhaustive monitoring; monitoring often limited to significant, upper-tier suppliers and contractors <p>Because monitoring is retrospective, it should be enhanced by adding more measures related to training efforts to proactively avoid human rights issues.</p>
Consumers' health & safety	Product health & safety	Consumer related toxicity potential as measured in ELCA; DALY of consumers	<ul style="list-style-type: none"> - Health and safety currently only consensual impact assessment category - Indicators related to consumers aim at measuring health damages when customers and consumer use a product
	Injuries, diseases, and fatalities	Number & percentage of affected consumers	<ul style="list-style-type: none"> - Indicators related to workers aim at measuring health damages when workers pursue their occupation - Extant research often only vaguely mentions product and occupational health and safety without further elaboration; quantitative measures of injuries, diseases, and fatalities only describe situational performance without an actual assessment of impacts on human health
Workers' health & safety	Occupational health and safety	Worker related toxicity potential as measured in ELCA; DALY of workers	
	Injuries, diseases, & fatalities	Number & percentage of affected workers	Future research needs to validate importance of DALY as health impact assessment approach in SLCA and need to consider more anticipatory measures that assess efforts to protect workers and product users from health damages.

Table 3. Continued

Contribution to society's economic development	Employees & full-time equivalent employment	Number (and percentage) of (full-time) employees	-	Indicators aim to assess how companies generate jobs in countries where supply chain operations take place
	Employment stability	Number & ratio of hires and dismissals	-	Focus on employment generation in research may be due to availability of data and may not necessarily represent an organization's true contribution to economic development if considered in isolation.
Other	Stakeholders' satisfaction	Only generically mentioned	-	Indicators aim at assessing subjective experiences or feelings of impacted stakeholders
	Stakeholders' sensory & aesthetic perceptions	Only generically mentioned	-	Extant research only vaguely refers to such subjective indicators without elaborating detailed measurement approaches

Note: SLCA = social life cycle assessment; DALY = disability adjusted life years; ELCA = environmental life cycle assessment.

In terms of assessing relationships with local communities, the most frequently addressed SLCA subcategory is safe and healthy living conditions. To assess these conditions in local communities, researchers use a mixture of qualitative and quantitative indicators starting with a qualitative description of potential accident risks (e.g., potential explosions, oil spills, etc.; Cartelle Barros et al., 2015; Santoyo-Castelazo & Azapagic, 2014) toward quantitatively measuring local morbidity and human health depreciation (measured by disability adjusted life years (DALY); e.g., Baumann et al., 2013; Stamford & Azapagic, 2011).

Regarding relationships with value chain actors, researchers frequently use indicators that deal with promoting social responsibility among value chain actors. These indicators typically aim to verify suppliers' compliance with human rights and codes of conduct on a semi-quantitative yes/no scale (e.g., Harms et al., 2013; Kumar et al., 2014). Another typical, but more quantitative, indicator measures the number or percentage of (significant) suppliers and downstream contractors that have undergone screening on human rights and what actions (e.g., number of contracts canceled because of human rights violations) are taken after screening (e.g., Awaysheh & Klassen, 2010; Morali & Searcy, 2013).

To assess relationships with consumers, researchers typically address consumers' health and safety. Here, the scholarly use of indicators is divided between only generic mentions (without a narrative specification or quantitative units of measurement) of product health and safety (e.g., Maroun & La Rovere, 2014; Marshall et al., 2015) and detailed quantification approaches. Quantitative indicators range from the number of user injuries and diseases (e.g., Pishvaei et al., 2014; Seuring et al., 2003) to product toxicity potential as measured in ELCA (e.g., Santoyo-Castelazo & Azapagic, 2014; Yu & Halog, 2015) and the DALY of consumers (e.g., Baumann et al., 2013; Corbière-Nicollier et al., 2011).

Unsurprisingly, similar to the assessment of company–consumer relationships, researchers typically point to health and safety when assessing company–worker relationships. Several

researchers reveal the same weakness of frequently referring to the generic indicator of occupational health and safety without further elaboration (e.g., Azadi et al., 2015; Tyagi, Kumar, & Kumar, 2015), whereas others use quantitative indicators, such as the number or percentage of occupational diseases, injuries, and fatalities (e.g., Colodel et al., 2009; Papong et al., 2015) or the worker-related toxicity potential and DALY (e.g., Martinez-Blanco et al., 2014; Simas et al., 2014).

For assessing relationships with society at large, researchers concentrate on the contribution to economic development during life cycles and supply chains by quantitatively measuring the number of employees (e.g., Thornley et al., 2009; Yu & Halog, 2015), full-time equivalent employment hours (e.g., Klein & Whalley, 2015; Simas et al., 2014), and sometimes the employment stability (i.e., the number and ratio of hires and dismissals; e.g., Boukherroub et al., 2015; Lehmann et al., 2013). The social indicators captured within the SLCA subcategories per stakeholder group mostly describe situational features and attributes that are objectively verifiable and thus easy to assess (particularly, quantifiable indicators related to health impacts, such as illnesses, injuries, fatalities, or DALY; e.g., Baumann et al., 2013). However, extant empirical research also points to a critical gap in the SLCA subcategories because researchers increasingly integrate subjective experiences and perceptions (such as stakeholder satisfaction) into social performance measurement, which is virtually absent in the UNEP and SETAC (2013, p. 71) SLCA methodological sheets declaring that “satisfaction is [only] indirectly assessed by evaluating the [feedback] mechanisms provided by the enterprise.” Subjective impacts describe how stakeholders actually experience (in a cognitive, or perceptual sense) the social features described by the SLCA subcategories (Slootweg, Vanclay, & Van Schooten, 2001; Vanclay, 2002). For example, the incidence of child labor is a situational attribute, whereas the mental health and well-being of working children are a subjective experience (Jørgensen, Lai et al., 2010).

Indicators assessing subjective perceptual impacts go beyond situational descriptions and aim at answering the “so what?” question (Griffin, 2000), namely, why situational features are important to human life and why we care about them (Reitinger et al., 2011). This makes subjective impacts more difficult to assess than the other SLCA subcategories. However, the validity of the specific indicators used in research to assess subjective experiences and perceptions is debatable as they are often purely generic mentions of satisfaction (e.g., Tajbakhsh & Hassini, 2015b; Wiengarten & Longoni, 2015) and sensory and aesthetic perceptions (e.g., Maxim, 2014; Molinos-Senante et al., 2014). Overall, Jørgensen, Lai et al. (2010) argue that subjective indicators are more valid than objective indicators to assess whether stakeholders experience social impacts as harmful or beneficial. Achieving a more extensive assessment of subjective impacts requires a shift away from quantitative research methods to qualitative research (e.g., interviews) to assess stakeholders’ inner perceptions of performance during life cycles and supply chains across industry sectors.

2.6. Critical shortcomings and research implications

After discussing the state of the field of SLCA indicators from an industry sector perspective, we now turn to a more overarching synthesis of critical shortcomings in the overall field to recommend avenues for future research. Hitherto, most researchers were eager to propose their own diverse and fragmented SLCA indicators and assessment approaches (Arcese et al., 2016), and overlooked several core issues in the field, which prevents a consolidation of the field. To overcome this limitation, we propose a research agenda organized according to the three key phases in the development of performance measurement approaches (Bourne, Mills, Wilcox, Neely, & Platts, 2000; Searcy, 2012) such as SLCA: (1) design of SLCA, (2) implementation and use of SLCA, and (3) evolution of SLCA.

The design phase of performance measurement approaches deals with the identification of key social aspects to be considered and the development of adequate corresponding indicators (Bourne et al., 2000). The majority of researchers devote their efforts to the design aspects of SLCA by deriving indicators from prior literature (e.g., Aparcana & Salhofer, 2013; Lehmann et al., 2011) or existing frameworks (e.g., Corbière-Nicollier et al., 2011; Varsei et al., 2014) to justify their selection based on existing references. However, a deeper elaboration of the rationale behind the inclusion of SLCA indicators is usually missing (e.g., Halog & Manik, 2011; Häni et al., 2003). Some authors even suggest SLCA indicators without any justification (e.g., Chang et al., 2011; Oum, Pathomsiri, & Yoshida, 2013). Few authors engage in a deeper discussion of the relevance and validity of SLCA indicators by engaging directly with businesses' stakeholders (e.g., Matos & Hall, 2007; Seuring et al., 2003) to reflect on the importance of indicators or to reveal social issues otherwise overlooked. Although researchers have made many important contributions to the design of SLCA indicators, there are still some important implications for future research. Many of the existing efforts to design and test SLCA indicators are based on single case studies so that the broad applicability of the indicators can be questioned. Moreover, the suitability of such indicator sets as practical management tools can be criticized, because they often include too many indicators, which are also overly generic.

The implementation and use phase which addresses the procedures put in place to regularly collect and process data to support decision-making and derive recommendations for action (Bourne et al., 2000) has largely been neglected in research, so far. Martinez-Blanco et al. (2014) point to implementation challenges such as problems of indicator selection and data collection when the whole life cycle is to be included in SLCA. Neugebauer et al. (2015) even propose a conceptual indicator selection and implementation process that, however, has yet to be empirically tested. Overall, only few authors directly engage with companies (e.g., Morali & Searcy, 2013; Taplin et al., 2006) to provide empirical insight how SLCA indicators are

integrated into mainstream business decision-making processes. Therefore, several gaps remain to be investigated in future research. First, more research is needed to investigate factors that determine the implementation, success, and failure of SLCA in business practice. There are only initial efforts (e.g., Mani, Agrawal, & Sharma, 2015; Spence & Rinaldi, 2014; Varsei et al., 2014) that reveal how internal and external factors such as firm capabilities or supply chain structure hinder or enable SLCA practices to respond to stakeholders' expectations. Furthermore, there is only a limited understanding of how companies perceive the relevance of social performance issues and what indicators they perceive as particularly useful in decision-making (e.g., Harms et al., 2013). Finally, questions remain on how existing and established internal systems (e.g., ELCA) can be used to leverage the implementation of SLCA, how the implementation of SLCA improves social performance, and whether/how SLCA can even create competitive advantage (e.g., Gualandris et al., 2015).

The evolution phase puts the focus to the feedback and learning processes which includes changing, replacing, and deleting indicators (Bourne et al., 2000). Research on the evolution of SLCA is virtually absent in extant research. Although SLCA is a developing field, it is not new anymore so that research on its evolution is needed to ensure its applicability and usefulness in the future. Research on the evolution of SLCA in business practice would be especially important because the evolution of performance measurement has the potential to challenge and change strategic assumptions, for example, from short-term profit thinking to long-term progress of social responsibility and sustainable development (Bourne et al., 2000). Spence and Rinaldi (2014) investigate how social accounting influences the transition towards sustainability in the supply chain and conclude that institutionalized practices prevent a shift away from economic imperatives. However, they only examine the effects of the introduction of social accounting and not the effects of its evolution. Therefore, more (longitudinal) research

is necessary to investigate whether and how the long-term use and evolution of SLCA can trigger a social sustainability transformation.

2.7. Conclusion

Social performance is an important area in the domains of IE and management research. Therefore, scholars are increasingly striving to achieve a comprehensive understanding and valid measurement of social performance to influence the overarching sustainability performance construct. This review of the literature offers valuable findings for future research on social indicators.

All 141 reviewed scholarly articles claim to incorporate a life cycle or supply chain perspective. Therefore, we initially expected a balanced distribution of social indicators across the SLCA subcategories. Instead, we found that researchers concentrate heavily on worker- and health-related indicators, thus neglecting to assess social impacts on multiple stakeholders. In particular, the neglect of value chain actors and consumers is a critical shortcoming in extant literature, as researchers thus overlook important upstream and downstream consequences of organizational conduct. Such a focus on focal company performance points to a dearth of rigorous life cycle thinking in social performance measurement research. Thus, we argue that the field still lacks a truly systemic IE orientation and largely neglects the “big picture” of social performance in life cycles and supply chains. A critical reason is that the majority of the sample is a-theoretical. Only a few researchers base their reasoning on an explicit theoretical reference point. This fragile theoretical base on which much SLCA research is resting is a concern that needs to be addressed in future research. Future contributions to the theoretical understanding in the field may be particularly useful for the development of valid impact pathways for the impact assessment phase in SLCA.

Overall, it is striking that researchers use indicators that address similar SLCA subcategories across industry sectors. This surprising finding differs from the established view (e.g., Boukherroub et al., 2015) that sector affiliation is a decisive factor and determinant of variations in social performance measurement. This substantiates that standardization in social performance measurement crosscutting industry sectors is possible. Therefore, as a step toward a more coherent understanding of social performance, we contributed to the literature by synthesizing the minimum set of social indicators typically used in empirical research across industry sectors. This is worthwhile, because a certain consensus is a precondition for establishing a standard set of social indicators. We highlighted typical measurement approaches and the rationale for the inclusion behind these SLCA indicators. Furthermore, we contributed by emphasizing critical challenges in applying these indicators and by providing recommendations for their future development.

Finally, a contribution lies in the synthesizing of critical shortcomings in the SLCA field organized along the key phases of design, implementation, and evolution through which performance measurement approaches such as SLCA typically progress in their development and maturation. With this, we provide a starting point and guide to future research to address existing shortcomings and contribute to the scientific discussion about the important social performance dimension of LCSA in IE research.

3. Second study: “Toward systemic social performance measurement: From a literature review to a conceptual framework”¹¹

Abstract The integration of social indicators into sustainability performance measurement systems has only recently gained momentum in research and corporate practice. Consequently, a universal understanding of indicators measuring businesses’ social impact is lacking. In this

¹¹ Resubmitted after revision to the Journal of Cleaner Production (single authored).

study, I systematically evaluate research on social indicators from an open systems theory perspective and identify trends and gaps. Overall, few articles based their reasoning on a theoretical foundation such as systems theory or stakeholder theory; the field is largely a-theoretical and thus still immature. I argue from a systems theory perspective that extant research lacks a systemic orientation in social performance measurement and propose determinants explaining this shortcoming. On the basis of these propositions, I develop a conceptual framework as a guide to future research. The framework adopts a systemic perspective for a holistic evaluation of social performance.

3.1. Introduction

Organizational performance is a central idea in management and strategy research, and scholars recognize its importance as the “ultimate dependent variable” (Richard et al., 2009: 719). Yet, the concept is becoming increasingly complex as organizations look beyond the financial bottom line and seek to integrate ecological and social aspects (DeNisi & Smith, 2014) to arrive at a holistic operationalization and measurement of sustainability performance.¹² Sustainability performance measurement is a process of collecting, analyzing, and communicating information about sustainability impacts to support internal management decisions in terms of improving the interactions between business, society, and the environment (Maas et al., 2016b).

Central to sustainability performance measurement is the use of performance indicators to capture and consolidate information (Lamberton, 2005; Schöggl et al., 2016).¹³ The use of

¹² Sustainability performance is a systems-based concept that necessitates an understanding of the dynamic interactions between business and its social-ecological environment (Gray, 2010). From a systemic perspective, sustainability performance measurement provides information to support the ability of organizations to persist, adapt, and transform in the light of constantly changing conditions in the system environment (i.e., society, economy, and nature; Williams et al., 2017).

¹³ Since there is no overall accepted definition of the term “indicator” (Heink & Kowarik, 2010), I refer to the one in Merriam-Webster dictionary, which characterizes an indicator as an instrument that shows the existence or condition of something (Merriam-Webster, 2016).

sustainability indicators can serve various decision-making functions, for example, benchmarking performance, tracking progress over time, assessing alternative processes to manufacture a given product (Maas, Schaltegger, & Crutzen, 2016a; Morioka & Carvalho, 2016), monitoring supply chain performance (Fritz, Schögggl, & Baumgartner, 2017; Hassini et al., 2012), and assessing product-related impacts on the ecological environment (Guinée et al., 2011) or on the wellbeing of stakeholders (Musaazi et al., 2015; Wilhelm, Hutchins, Mars, & Benoit-Norris, 2015), which includes meeting stakeholder requirements and enhancing legitimacy (Rodrigue, Magnan, & Boulianne, 2013).

However, unlike established approaches for measuring economic and ecological performance, there is currently no standardized set of measures for corporate social performance (CSP) in the context life cycle assessment and supply chain-wide sustainability assessment (Fritz et al., 2017). Despite recent frameworks and assessment guidelines that underline the increasing importance of social performance measurement (e.g., Roundtable for Product Social Metrics, 2016; UNEP & SETAC, 2009, 2013), researchers emphasize the inability of existing frameworks to guide the selection of indicators, as the selection is guided more by what can be measured (technically) rather than by what should be measured (normatively; Salvado et al., 2015). Consequently, the assessment of the social pillar of sustainability is still in a developmental stage (Croes & Vermeulen, 2015; Fritz et al., 2017; Schögggl et al., 2016). Owing to inconsistent approaches, social performance measurement suffers from problems of validity, reliability, and generalizability (Croes & Vermeulen, 2015; Maas et al., 2016b; Rowley & Berman, 2000). The context specific nature of social performance can be a barrier to generalizability due to factors such as regional socio-economic conditions at the location of operation, firms' sustainability orientation, stakeholders' expectations and salience, and the industrial sector (Boukherroub et al., 2015; Gualandris et al., 2015; Siebert, Bezama, O'Keefe, & Thrän, 2017). Therefore, researchers and practitioners often use different

and non-equivalent indicators that they subjectively believe are most important (Webb, 1974). Consequently, scholars looking to compare the social performance of different supply chains and product life cycles face unreliable results (Antolín-López et al., 2016; Hassini et al., 2012; Schöggl et al., 2016). This generates confusion among information users, which reduces the likelihood to find and implement socially responsible and sustainable solutions (Weidema, 2014). Therefore, I argue that generalization and standardization of social performance measurement and indicators is needed to provide uniform rules and avoid unnecessary variation. Consistently, recent research calls for the generalization and standardization of social performance measurement and social indicators along supply chains and product life cycles (Ahi & Searcy, 2015; Antolín-López et al., 2016; Croes & Vermeulen, 2015; Schöggl et al., 2016). Against this background, this paper evaluates trends, coherences, and inconsistencies in academic research on CSP measurement.

One of the most difficult challenges specifically associated with CSP is measuring it relative to the claims of the stakeholder environment (Parmar et al., 2010), which sets the leveling rule of expectations toward the company. To account for the linkages between an organization and its broader context, (Humphrey and Aime, 2014) argue that the open systems theory provides a valuable perspective, because it emphasizes the embeddedness of an organization within its stakeholder, resource, and institutional environment. Open systems theory argues that an organization is viable if it is capable of responding to changes, risks, and opportunities in its environment (Jackson, 1988). To achieve this capability, organizations depend on adequate (systemic) accounting information (Lowe & Tinker, 1977). Recent research calls for an expansion in the scope of organizational performance measurement (Wood, 2010), beyond organizational boundaries (Searcy, 2016) and along corporate supply chains and product life cycles (Ahi & Searcy, 2015; Fritz et al., 2017; Schöggl et al., 2016) to include the upstream and downstream consequences of organizational decision-making (Lamberton, 2005; Whiteman et

al., 2013). Most studies still lack such a holistic approach (Whiteman et al., 2013), which may prevent companies from reaping the benefits of sustainability performance measurement in supporting internal decision-making (Mitchell et al., 2015). Others, such as (Brammer, Hojmosse, and Millington, 2011), extend their thinking by identifying environmental pressures (especially, consumer pressure and regulation) that drive organizational engagement with sustainable supply chain management beyond the consideration of the isolated organization. However, they only partly engage in a specific analysis of performance measurement and the selection of indicators. Against this background, this paper answers the following research question: In how far are the social indicators currently emphasized in research sufficient for achieving a comprehensive and system-wide analysis of CSP?

I provide a comprehensive overview and analysis of concrete (life cycle-oriented) social performance indicators and add to the few existing overviews of social life cycle assessment, which contain a general analysis of methodological issues on a rather abstract level (Macombe et al., 2013) or concentrate on isolated social performance measures (Ahi & Searcy, 2015). I argue that this extension is necessary, because adequate indicators are needed to evaluate the effectiveness of sustainability-related decision-making (Hutchins & Sutherland, 2008). Thus, I aim at contributing to the generalization of social performance measurement which, in turn, is a requirement to achieve comparability of social performance at the levels of products, organizations, and supply chains (Eastwood & Haapala, 2015). Specifically, I provide insights on which social indicators are used and why; a worthwhile exercise, as the selection of meaningful social indicators deemed useful by business organizations is still poorly understood (Richard et al., 2009; Rodrigue et al., 2013; Whitehead, 2017). By providing a clear structure of connected components, the open systems theory facilitates the identification of factors across the components that shape the selection and use of CSP measures (Mitnick, 2000). Accordingly, another research question is: What factors determine the use of social indicators in

organizational performance measurement along the system components? Through a conceptual extension of the reviewed literature, I develop several propositions explaining the nature of social performance measurement in business organizations and offer a conceptual framework for a holistic and systemic assessment of the comprehensive “big picture” (Whiteman et al., 2013) of social performance. In particular, my systemic framework explains how the interrelation of determinants in business organizations, supply chains, and the external system environment influences the (currently often lacking; Croes & Vermeulen, 2015) comprehensiveness when assessing social performance along product life cycles and supply chains. Thus, my systemic framework helps to determine which social issues to measure and counters the weakness of existing frameworks of being more descriptive than analytic (Whitehead, 2017). The framework synthesizes my findings and propositions, thus providing theoretically grounded avenues for future research. Consequently, the value of the systemic framework lies in triggering a shift from primarily descriptive research toward theory development and consolidation (Touboulic & Walker, 2015) in social performance measurement research.

My paper is constructed as follows. First, I briefly introduce the open systems theory to offer a foundation for further analysis. Second, I describe my method of my review including its limitations. Third, I analyze and discuss the main findings in the context of the open systems theory to develop propositions for the use of social performance indicators. Fourth, I synthesize my findings and propositions by developing a conceptual framework, providing theoretically grounded as well as practice-driven avenues for future research. I conclude the paper by highlighting my main contributions.

3.2. Theoretical background

The systems theory perspective offers an analytical lens that is capable of evaluating the completeness of management accounting (O'Grady, Morlidge, & Rouse, 2016). Systems theory has had a long history within the organizational sciences, and "systems" have become a key concept in general management (Morel & Ramanujam, 1999; Peery, 1975) and management accounting (Hopper & Powell, 1985). Systems can be considered as closed or open. A closed system does not interact with its environment and is thus subject to entropic processes, resulting in disorder and ultimately causing the system's disappearance. Open systems, however, can theoretically survive indefinitely, because they interact with their environment (Peery, 1975). From an open systems theory perspective, a business organization can be conceived of as an open socio-technical system interacting with its larger environment by providing inputs (e.g., physical substances, human and financial resources, and information) to a reconfiguration process and emitting outputs into its larger environment (Hutchins & Sutherland, 2008; Wood, 2010). Not only is the flow through the system determined by physical materials and energy but it also causes economic and social concerns (Azapagic, 2003; Korhonen, 2007). The hitherto neglected social performance dimension results from the harms and benefits caused by the interactions between a business organization (i.e., an open system) and its stakeholder environment (Hopper & Powell, 1985; Husted, 2000; Wood, 2010).

Currently, social performance measurement approaches struggle to factor in interactions with stakeholders, because they put the isolated business organization at the center of the analysis (Mitchell et al., 2015). Instead of such a firm-centric analysis, the open systems theory implies that social performance extends beyond the boundaries of the organization and includes stakeholders' social concerns along corporate supply chains and product life cycles (Isaksson et al., 2010). Instruments for assessing such (system-wide) concerns are indicators used in social life cycle assessment (SLCA; Shokravi & Kurnia, 2014), which support companies in adapting

their behavior to the interests of stakeholders (Freeman, 1984) and, consequently, in securing access to critical resources such as legitimacy (Suchman, 1995). Hence, stakeholders can have a determining influence on how firms measure social performance (Harrison & Van der Laan-Smith, 2015; Rodrigue et al., 2013; Whitehead, 2017).

In order to interact with the stakeholder environment and thus perform functions and create value (Mitchell et al., 2015), systems share a common structural configuration composed of a set of interconnected components (Ashmos & Huber, 1987; Williams et al., 2017). System theorists assume that the performance of each constituent is responsible for the performance of the system as a whole (De Haas & Kleingeld, 1999). Therefore, (Mitnick, 2000) argues that social indicators should span across all system components (i.e., performance measurement areas) to allow for a comprehensive and system-wide analysis of social performance.

In his model, (Mitnick, 2000) outlines an organization as an open system consisting of interacting system components. The administrators/governors of a system monitor and guide the conversion of inputs through transformation processes into outputs and terminal outcomes that finally cause feedback effects. Performance measurement captures social issues occurring throughout the system and thus assures a comprehensive and system-wide analysis of social performance (Mitnick, 2000). Table 4 provides descriptions of each system component along with an elaboration of the relevance for social performance measurement and the development of social indicators. Overall, the open systems perspective is congruent with life cycle thinking, and it extends these concepts beyond the physical material flow by integrating intangible aspects of governing (administration), perceiving (outcomes), and reacting (feedback) to that flow.

Table 4. Open systems' components and their relevance for social performance measurement

Open systems' components	Description of components	Relevance of the components for social performance measurement and the development of social indicators
(1) System administration and governance	The administration and governance component refers to the decision-makers who moderate the function of the whole system. This component represents the "brain" which defines goals and plans, coordinates interactions with the stakeholder environment, and controls the flow through the operating components.	Whitehead (2017) argues that current performance measurement frameworks neglect indicators that assess governance performance. Such indicators can be used to show how well an organization is achieving its overall business strategy (Hubbard, 2009). For example, the ISO 26000 framework only offers a vague snapshot of generic social criteria to evaluate and review strategy (Hahn, 2013).
(2) Consumptive and contributory inputs	The first operating component consist of the consumptive and contributory resources, materials, and services that become inputs for the reconfiguration/transformation process.	Searcy (2016) emphasizes that firms need to extend performance measurement beyond their own organizational boundaries to consider performance of input suppliers in their upstream supply chains. Society at large includes further inputs, such as investors' capital, employees' work, and legitimacy in communities to account for in social performance measurement.
(3) Throughput processes	The second operating component refers to input reconfiguration through production processes and the workforce.	Hubbard (2009) finds that current performance measurement frameworks are heavily process focused and primarily use indicators that assess workers' health and well-being.
(4) Outputs	The third operating component encompasses the outputs/results of organizational activities, such as final products (goods and services).	Seuring (2004) argues that the flow and reconfiguration of inputs depend on the outputs to be produced. Despite the importance of outputs (e.g., products), performance measurement concentrates on social indicators in the upstream supply chain and the focal company, but neglects downstream consequences, e.g., when using, or disposing final products (Baumann et al., 2013).
(5) Outcomes	Certain social and ethical issues along the operating components are beyond the immediate control of firms, because they are more closely related to stakeholders' subjective perceptions and experiences (i.e., outcomes) of these issues.	Indicators assessing outcomes performance aim at answering the "so what?" (Griffin, 2000) question of why features of the other components are of importance in a human life (Reitinger et al., 2011). This makes outcomes performance more difficult to assess than the other components. Current frameworks overly focus on processes instead of outcomes, although it is the outcomes which people fundamentally care about (Hubbard, 2009).
(6) Stakeholders' reactions and feedback	Finally, outcomes generate feedback reactions from stakeholders. Feedback loops are vital for systems to be interconnected because feedback makes the consequences of decisions made in the governance component evident. Thus, feedback supports system governors to proactively manage system behavior instead of reacting passively to critical events in the system environment (Williams et al., 2017).	The development of indicators that capture stakeholders' reactions and feedback to corporate activities (e.g., indicators of stakeholder consultation and involvement) assists in broadening firms' perspective toward current and future public concerns which may be overlooked otherwise (Von Geibler, Liedtke, Wallbaum, & Schaller, 2006). Furthermore, compared to environmental indicators, social indicators lack a common foundation in natural sciences, so that strategically relevant social indicators need to be identified and prioritized depending on the values and preferences of the stakeholders involved and affected (Figge, Hahn, Schaltegger, & Wagner, 2002).

Overall, the open systems theory is a useful lens of structuring and analyzing social performance measurement. While traditional management theories tend to have a firm and industry focus in isolation from socio-ecological systems, the open systems theory offers a more holistic lens to investigate the interactions of firms with their surrounding socio-ecological system environment (Whiteman et al., 2013; Williams et al., 2017). Recognizing the interdependence between organizations and their system environment is pivotal in systems thinking. Open systems can be characterized as a set of elements that behave according to governing mechanisms, depend on their system environment for inputs to generate organizational outputs and activities, and influence their system environment through feedback loops (Starik & Kanashiro, 2013). Therefore, systems thinking is more suitable than traditional management theories to address interconnected social and sustainability challenges and can provide new insights about management and performance measurement (Williams et al., 2017).

3.3. Method

The aim of this paper is to identify trends, relationships, inconsistencies, and gaps in the scholarly literature (Crossan & Apaydin, 2010). Furthermore, it aims at a conceptual synthesis and extension of the literature by building up several propositions on social indicators in performance measurement which may guide future research. To achieve this, I followed the advice of (Fink, 2014), (Tranfield, Denyer, and Smart, 2003), and (Rousseau, Manning, and Denyer, 2008) on how to approach systematic literature reviews and synthesize knowledge which also helped to ensure objectivity of the process. As sources for identifying the literature, the Social Science Citation Index was used because it includes all journals with an impact factor, which are known to be the most important publications in the field. It extensively covers English-language peer-reviewed journals in business, management, and accounting. This was supplemented with the EBSCO Business Source Premier database. While the selection of the database may be considered a limitation, relying on two major databases ensured a broad

coverage of the relevant literature. The databases selected also contributed to validity because of their extensive coverage of high-impact peer-reviewed journals (Podsakoff et al., 2005).

In both databases, an extensive keyword search identified relevant articles published up to the end of 2015. The search specifically focused on scholarly articles whereas book reviews, news pieces, editorial notes, comments, etc. were excluded. A combination of anchor keywords and additional search strings developed through an extensive iterative process of search and discussion between the author of this paper and other academics from the field of sustainability assessment and management enabled me to locate articles that sufficiently cover the relevant literature of systemic social performance measurement. Table 5 provides a detailed description and explanation of the specific search strings used as well as the resulting hits for each string and database. Particularly, searching for the wildcards soci*, sustainab*, integrat*, responsib*, CSR, TBL, or “triple bottom line” enabled me to locate articles incorporating the social dimension of sustainability performance. To ensure that the identified articles have an open systems orientation beyond isolated organizational boundaries, these anchor wildcards were complemented with the keywords “life cycle” or “supply chain.” Furthermore, to locate articles about performance measurement, assessment, and accounting, I added the wildcards assess*, analy*, account*, quanti*, indicator*, index, indices, measur*, metric*, or criteria. The use of this rather complex combination of keywords in an attempt to find articles incorporating the social dimension of sustainability, performance measures, and life cycle thinking may be regarded as a limitation. However, I consider this necessary because, from the open systems perspective, simpler search terms yield an inferior selection of research papers.

Table 5. Search strings and rationale of the systematic literature review approach

Search Strings and Rationale	Results in SSCI	Results in EBSCO
1st search string: TI=(soci* OR sustainab* OR integrat* OR responsib* OR CSR OR TBL OR “triple bottom line”) AND “life cycle”) AND TS=(soci* AND (assess* OR analy* OR account* OR quanti* OR indicator* OR index OR indices OR measur* OR metric* OR criteria))	70	42
Combination of the alternative anchor keywords soci*, sustainab*, integrat*, responsib*, CSR, TBL, or “triple bottom line” in the title search together with the anchor keyword soci* in the topic search as fixed basis for all search strings. Thus, the identified articles always addressed the social dimension of sustainability, since an abundance of papers on sustainability often exclusively deal with ecological or economic concerns. I complemented the anchor title search with “life cycle” while simultaneously combining the anchor topic search with keywords targeting performance measurement (e.g., assess*) in order to locate articles dealing with social indicators or performance measures from a life cycle and systems theory perspective.		
2nd search string: TI=((soci* OR sustainab* OR integrat* OR responsib* OR CSR OR TBL OR “triple bottom line”) AND (assess* OR analy* OR account* OR quanti* OR indicator* OR index OR indices OR measur* OR metric* OR criteria)) AND TS=(soci* AND “life cycle”)	123	58
Complementary keyword “life cycle” now in the topic search instead of the title search and the performance measurement keywords (e.g., assess*) now in the title search instead of the topic search to avoid missing any relevant articles.		
3rd search string: TI=((soci* OR sustainab* OR integrat* OR responsib* OR CSR OR TBL OR “triple bottom line”) AND “supply chain”) AND TS=(soci* AND (assess* OR analy* OR account* OR quanti* OR indicator* OR index OR indices OR measur* OR metric* OR criteria))	101	172
Repeats the first search run replacing the complementary keyword “life cycle” with “supply chain” for a broader coverage of relevant articles.		
4th search string: TI=(soci* OR sustainab* OR integrat* OR responsib* OR CSR OR TBL OR “triple bottom line”) AND (assess* OR analy* OR account* OR quanti* OR indicator* OR index OR indices OR measur* OR metric* OR criteria)) AND TS=(soci* AND “supply chain”)	81	62
Repeats the second search run replacing “life cycle” with “supply chain” in the fourth and final search string for broader coverage or relevant article.		
Number of papers (excluding duplicates)		467
Number of papers with substantial relevance for this literature review after screening		141

Note. In the SSCI database, the search strings can be entered directly via advanced search, whereas the EBSCO database uses an entry mask requiring to manually select search fields. In both databases the title search field (TI) is equivalent. But in SSCI, the topic search (TS) encompasses titles, abstracts, and keywords, whereas EBSCO is confined to an abstract-only search field (AB), instead of a topic search.

Following the initial search, each article was screened to assess whether its content was essentially relevant to social performance measurement in the business sphere. In the end, 141 papers with substantial relevance to (life cycle-oriented) social indicators for system-wide performance measurement were identified (Appendix II provides a complete list of the reviewed articles).

My next step was to apply an abductive approach for analyzing the material. Abduction is based on a reiterative combination of a researcher's sophisticated understanding of theoretical frameworks with inspiration from the data (Alvesson & Kärreman, 2007; Van Maanen, Sørensen, & Mitchell, 2007). An abductive analysis aims at interpreting perceived phenomena by relating them to similar observations that are already experienced and explained in other situations (Timmermans & Tavory, 2012). (Alvesson and Kärreman, 2007) stress the need for a combination of theories allowing researchers to consider multiple perspectives in an abductive interpretation. Employing this abductive logic to my research, my review combines multiple theory perspectives structured along the open systems' components in order to explain why and which social indicators are applied in research. First, I assigned social indicators to the components of the open systems to identify coherences and inconsistencies in their use within research. Although I aspire to achieve generalizable findings through an extensive search process covering the scientific field exhaustively, I do not claim that my findings can in fact be generalized beyond the reviewed sample. Based on the findings of the review, I drew on similar observations theorized in other situations to transfer the reasoning to the use of social indicators in organizational performance measurement. I conceptually articulated new theoretical propositions about factors determining the use of social indicators across all open systems' components.

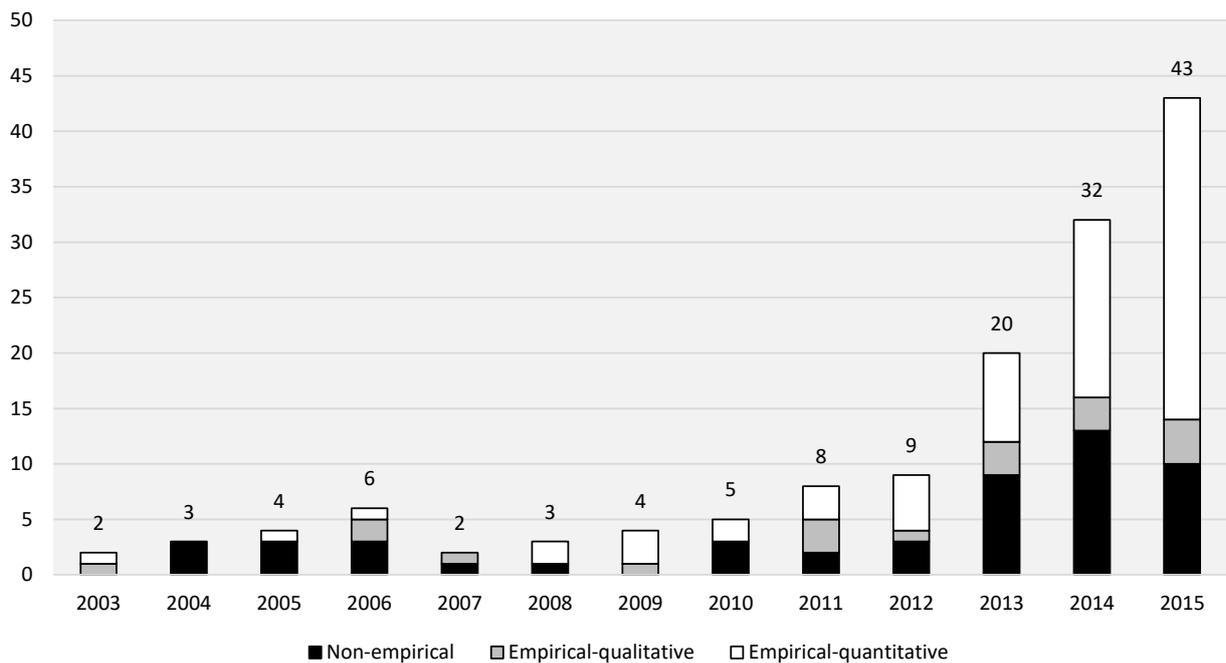
3.4. Results

From the review sample, five journals published five or more articles (*Journal of Cleaner Production* (21), *Sustainability* (16), *International Journal of Life Cycle Assessment* (15), *Supply Chain Management: An International Journal* (7), and *Journal of Business Ethics* (5)). Consistent with Williams et al. (2017) who argue that systems thinking is only peripheral in mainstream organizational and management journals, I find that core management journals seldom publish research on systemic approaches for social performance measurement such as life cycle assessment. With the *Journal of Cleaner Production* as the leading publication outlet, the majority of articles (91) was published in journals related to business ethics or social, environmental, and sustainability topics followed by journals from the area of production and operations (31). Interestingly, only two articles in two journals from the accounting discipline are among the list of publication outlets along with another seventeen articles in other specialty journals.

Figure 6 illustrates that research on the integration of social indicators in corporate performance measurement emerged at the beginning of the new millennium and continues to increase. The increase from 2011 onward may have been triggered by the publication of social responsibility guidance documents at the end of the first decade of the 2000s¹⁴, from which a growing number of papers derived their social indicators.

¹⁴ For example, the social life cycle assessment guidelines by the UNEP and SETAC (2009) or the ISO 26000 guidance standard on social responsibility by the ISO (2010).

Figure 6. Distribution of the literature over time and research approaches



From a research method perspective, empirical studies make up for the majority of research with approximately 63% of the reviewed literature sample. 71 articles (~50% of the sample) are quantitative studies. This relatively high number may point the progressing of social performance measurement from a conceptual foundation to a more quantitative application of social indicators. The number of qualitative studies, however, has remained static from year to year with only 19 paper (~13% of the sample). This is interesting considering that social issues are often not easily quantifiable and instead of a qualitative nature. If important qualitative indicators are neglected in favor of more easily quantifiable issues, the comprehensiveness of social indicators in performance measurement can be questioned. The neglect of qualitative research could especially impede the development of meaningful social indicators addressing the outcomes performance area, because assessing the subjective experience of stakeholders requires research methods such as in-depth interviews.

Non-empirical (conceptual) articles sum up to roughly 37% of the reviewed literature (51 papers). Despite including a total of 14 literature reviews, these reviews still provide only partial

insights on social indicators, they either deal with isolated matters (Pizzirani et al., 2014) and single industries (Macombe et al., 2013), or they focus on overarching concerns such as modeling approaches for sustainable supply chain management (e.g., Brandenburg et al., 2014; Seuring, 2013). Other conceptual papers (37 articles) suggest, identify, or develop social indicators, and often discuss their integration into a more holistic sustainability assessment framework along life cycles and supply chains.

Another issue highlighting the compromised nature of system-wide social performance measurement is the unequal distribution of social indicators over the system components as illustrated in Figure 7.¹⁵ Researchers primarily address the outcome (104 articles) and process (101 articles) components. This is not surprising, considering that existing conceptualizations of social performance measurement tend to focus on worker health and safety issues when monitoring organizational and supply chain operations, and thus run the risk of overlooking impacts on multiple stakeholders (Gualandris et al., 2015).

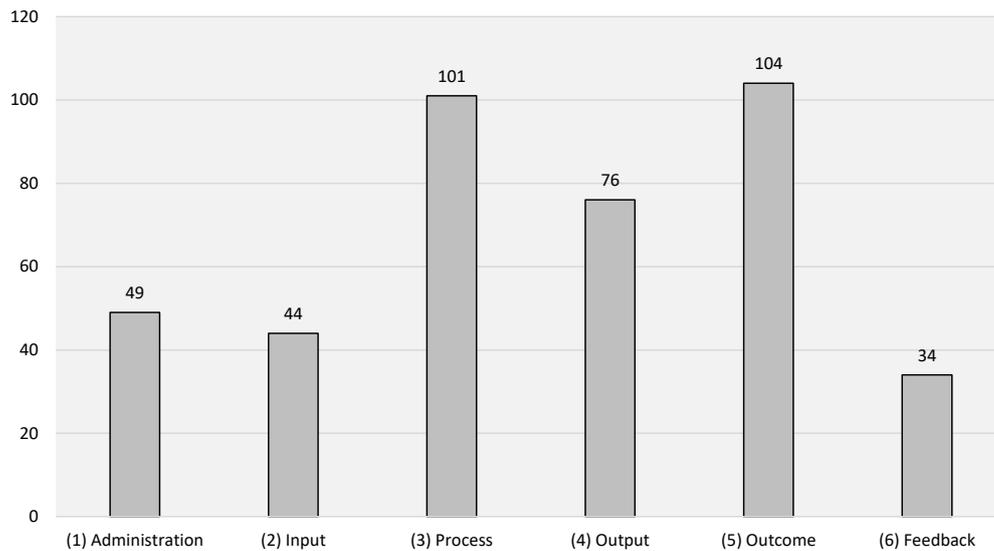
Output-related issues (76 articles) are moderately considered. Although not on par with worker- (process) and health- (outcomes) related issues, the relevance of assessing outputs is increasing in recent research, especially in terms of assessing performance of final products. In this context, the social life cycle assessment literature has attracted great interest (Arcese et al., 2016). Researchers in the field who discuss the selection of meaningful indicators struggle with the lack of standardization and face problems of developing impact pathways that directly relate performances along product life cycles with impacts (usually health outcomes) on people's lives (Feschet et al., 2013; Neugebauer et al., 2015; Wu et al., 2015).

Indicators related to administration/governance (49 articles), input (44 articles), and, especially, feedback (34 articles) are often neglected. Recently, issues of organizational and

¹⁵ Each social indicator in a single paper was individually classified within the six system components to analyze whether researchers emphasize certain performance measurement areas.

supply chain administration/governance have become increasingly important in social (and sustainability) accounting because of legitimacy, institutional, and stakeholder pressures (Spence & Rinaldi, 2014). However, little research has examined what governance issues are meaningful for social accounting (Antolín-López et al., 2016) and how these governance issues themselves determine social (and sustainability) performance (Spence & Rinaldi, 2014). The dearth of papers addressing input-related indicators is particularly surprising, considering that collaboration with suppliers (of inputs) is pivotal to improve overall supply chain sustainability performance (Seuring & Gold, 2013). From an open systems perspective, the lack of feedback-related indicators impedes a truly complete feedback loop that is necessary to compare the outcomes of organizational activities along supply chains and product life cycles with performance goals set by the system governors (Malmi & Brown, 2008). Overall, the results reflect a rather limited diffusion of open systems thinking in management research, which appears to neglect the “big picture” (Whiteman et al., 2013) of organizational social performance.

Figure 7. Distribution of the literature over the system components (i.e., performance measurement areas)



Note. Social indicators in a single paper may address multiple system components.

As a final analytical step, Table 6 provides an overview of a set of the most important social indicators along the system components and discusses the rationale for their inclusion, current shortcomings of applying them in practice, and recommendations for their future development. This represents a first step toward establishing a commonly accepted set of social indicators for system-wide performance measurement and maps social indicators across each system component in order to reveal consistencies, divergences, and (limitations of) the systemic orientation in social performance measurement research.

Table 6. Overview of the most frequently used indicators for systemic social performance measurement

System components	Indicators	Typical quantification approaches in research	Rationale for inclusion, shortcomings, and recommendations
(1) Administration and governance	Compliance with regulation and law	<ul style="list-style-type: none"> Semi-quantitative (yes/no) scale of compliance Number of regulatory violations 	<ul style="list-style-type: none"> Isolated concentration on legal compliance (due to coercive institutional pressures) neglects adherence to other governing mechanisms from the system environment <p>Measuring regulatory compliance should be concretized and complemented by assessing adherence to other important prescriptions from the system environment. For example, cultural considerations or voluntary social standards may go beyond regulatory requirements or even fill in the gap when regulation may be missing.</p>
	Promoting social responsibility among suppliers	<ul style="list-style-type: none"> Semi-quantitative (yes/no) verification of suppliers' compliance with human rights & codes of conduct Number & percentage of suppliers screened 	<ul style="list-style-type: none"> Indicators aim at promoting social responsibility by monitoring obligation of upstream and downstream value chain actors to respect basic human rights in their business operations and eventually take corrective actions Complexity of many supply chains impedes an exhaustive monitoring; monitoring often limited to significant, upper-tier suppliers and contractors <p>Because monitoring is retrospective, it should be enhanced by adding more measures related to training efforts to proactively avoid human rights issues.</p>
(3) Processes	Employment	<ul style="list-style-type: none"> Number (and percentage) of (full-time) employees 	<ul style="list-style-type: none"> Indicators aim at assessing how companies generate jobs at locations where business operations take place and if management practices support non-discrimination in terms of employment, training, hours of work, and the provision of social benefits and wages
	Equal opportunities and fair salary	<ul style="list-style-type: none"> Ratios of numbers of employees in terms of gender, ethnicity, disability, age, or origin Ratios of income distribution in terms of gender, ethnicity, disability, age, or origin Payment of a living wage above minimum wage 	<p>Focus on employment generation in research may be due to availability of data and may not necessarily represent an organization's true contribution to economic development if considered in isolation.</p> <p>Providing evidence of discrimination can be difficult by using desk research, anonymous surveys, or by solely referring to the composition of the workforce. A direct engagement with workers by using interviews can generate immediate insights into how discrimination takes place.</p>
	Product and service features	<ul style="list-style-type: none"> Functional utility in terms of time needed (or saved) to use a product Affordability in terms of total life cycle costs of products 	<ul style="list-style-type: none"> Indicators are only descriptive performance measures of product attributes and community development activities without indicating actual effects <p>The situational performance description should be enhanced by assessing the positive effect and contribution of products and community engagement activities on sustainable development.</p>
(4) Outputs	Local community engagement	<ul style="list-style-type: none"> Monetary investments in local community projects and infrastructure 	<p>The situational performance description should be enhanced by assessing the positive effect and contribution of products and community engagement activities on sustainable development.</p>

Table 6. Continued

	<ul style="list-style-type: none"> - Impacts of physical health are currently the only consensual impact category in social performance measurement - Indicators related to consumers aim at measuring health damages when customers and consumer use a product - Indicators related to workers aim at measuring health damages when workers pursue their occupation - Indicators related to local community members aim at measuring local morbidity and human health depreciation at the location of operation for a retrospective correction of business activities - Extant research often only vaguely mentions product and occupational health and safety without further elaboration; quantitative measures of injuries, diseases, and fatalities only describe situational performance without an actual assessment of impacts on human health - Local morbidity and human health depreciation aim at retrospective correction of business operations with negative health impacts on local community members 	
<p>(5) Outcomes</p> <p>Impacts on physical health of workers, consumers, and local community members</p> <ul style="list-style-type: none"> - Number of illnesses, accidents, and fatalities, Disability adjusted life years (DALY) 	<p>Future research needs to validate importance of DALY as health impact assessment approach social performance measurement and need to consider more anticipatory measures that assess efforts to protect workers, product users, and local community members from health damages.</p>	
<p>(6) Feedback</p> <p>Stakeholder engagement</p>	<ul style="list-style-type: none"> - Communication with stakeholders measured by number of stakeholders' suggestions, and stakeholder consultation - Stakeholder inclusion and influence on decision-making measured by number and percentage of stakeholders' suggestions implemented in practice 	<ul style="list-style-type: none"> - Organizational decision makers can influence the system environment through feedback loops, i.e., through including stakeholder feedback in decision-making - Stakeholder inclusion is marginal in social performance measurement research <p>Stakeholder feedback promotes the search for indicators. Furthermore, because firms are increasingly involved in their environment, measuring stakeholder inclusion is vital to fulfill the contractual and non-contractual relationships (e.g., license to operate) with their system environment.</p>

As can be seen from this analysis, the use of social indicators in research is still fragmented and inconsistent across the system components from an overall systems perspective. A reason might be that most studies are largely a-theoretical (see also Schaltegger & Burritt, 2014). Only 24 papers (~ 17% of the sample) elaborate their reasoning on social performance measurement with an explicit theoretical reference. The most frequently referenced theories are systems theory (10 papers) and stakeholder theory (8 papers).

Systems theory aims at understanding performance of the whole by analyzing the interactions between the elements or agents that compose the whole. Hence, from a systemic perspective, social indicators should capture important interactions between the different actors that compose the whole supply chain or product life cycle. Thus, systems theory helps analyzing the completeness of social performance measurement (Halog & Manik, 2011; Hutchins & Sutherland, 2008; Matos & Hall, 2007; Onat, Kucukvar, & Tatari, 2014; Papong et al., 2015; Sala et al., 2013b, 2013a; Salvado et al., 2015; Shih & Tseng, 2014; Yu & Halog, 2015). Stakeholder (salience) theory argues, that the legitimacy of an organization (or whole supply chain) can be threatened by powerful stakeholders that use their own legitimacy to make claims that should be addressed urgently by a firm's supply chain. Thus, stakeholder salience can be instrumental to the implementation, scope, and quality of social performance measurement (Arcese et al., 2013; Gauthier, 2005; Gualandris et al., 2015; Mathe, 2014; Matos & Hall, 2007; Morali & Searcy, 2013; Seuring et al., 2003; Varsei et al., 2014).

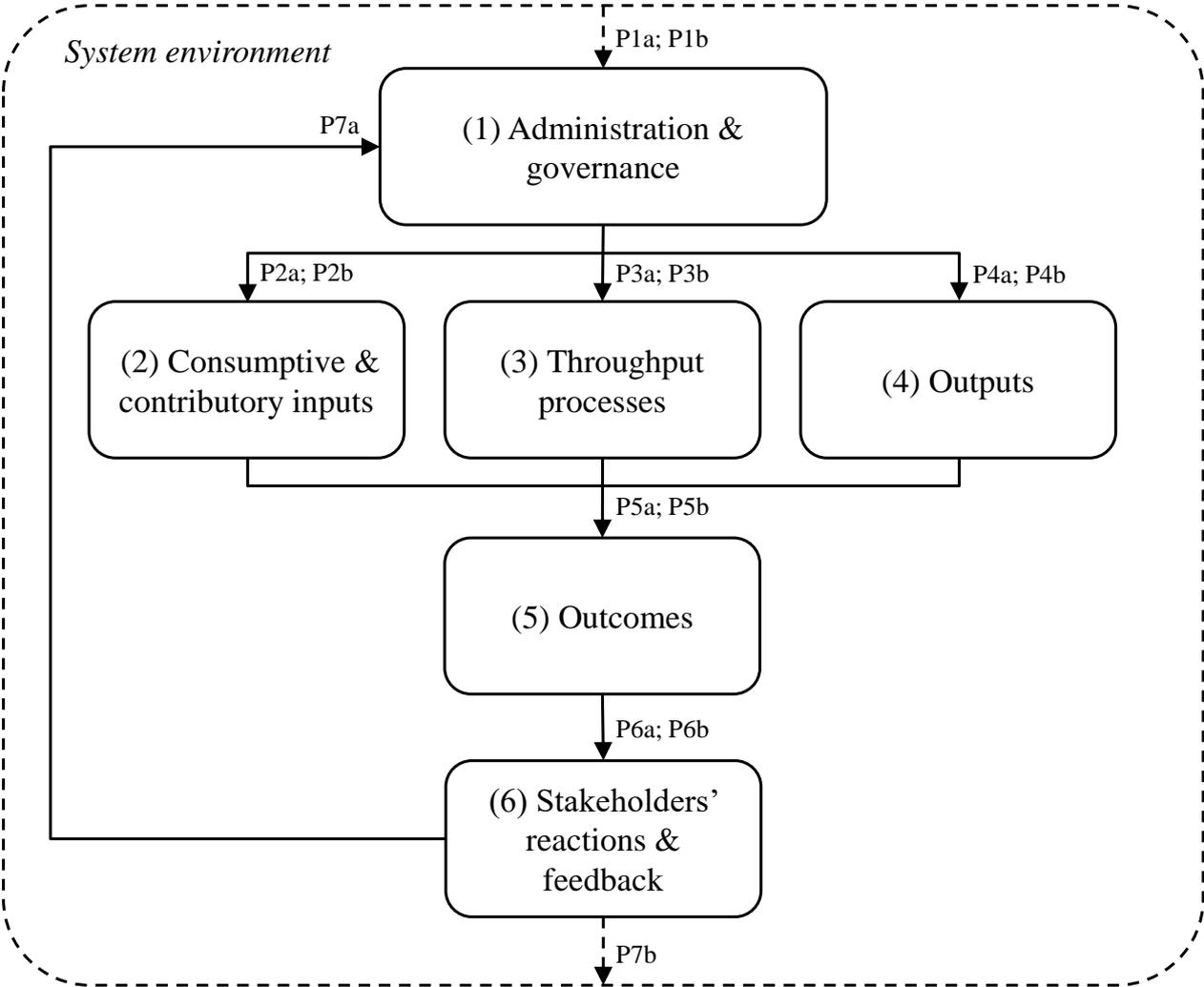
Despite the so far scarce theory-building efforts, future research could draw from the empirical richness of the field to support the maturation of social performance measurement. This would allow to move beyond a-theoretical and descriptive research toward theory development and consolidation (Touboulic & Walker, 2015). More contributions can emerge from the testing and combination of (underexplored and/or new) theoretical lenses. Therefore,

the next section conceptually develops a framework for social performance measurement that combines multiple theoretical perspectives under the umbrella of systems theory.

3.5. Conceptual development of a framework for systemic social performance measurement

On the basis of a theoretical discussion about the reasons determining the use of social indicators in research, I offer several propositions explaining which indicators are used, and why, in social performance measurement. Furthermore, I provide implications for research across all system components (i.e., performance measurement areas). Based on these propositions, I develop a conceptual systemic framework that explains the nature of social performance measurement (see Figure 8). The following elaborations explain the structure and logical interrelations between the elements of the framework. Specifically, the systemic framework illustrates how the interrelation of determinants in business organizations, supply chains, and the external system environment influences the assessment of social performance.

Figure 8. Proposed systemic framework of social performance measurement



3.5.1. Administration and governance performance measurement

Articles assessing the performance of the overall administration/governance component (of the isolated business organization within a supply chain) primarily measure adherence to prescriptions from the external system environment (particularly, regulation and law prescribed by governmental institutions; e.g., Martinez-Blanco et al., 2014; Tajbakhsh & Hassini, 2015a) for socially responsible decision-making (see again Table 6 for the most frequently used indicators per system component). Internal governance features are less frequently mentioned. This is surprising, considering that firms often prefer to assess adherence to voluntary initiatives, ethics policies, or codes of conduct, because they are relatively inexpensive and

unrestrictive (Mitnick, 2000). The emphasis on regulatory compliance points to coercive institutional pressure (DiMaggio & Powell, 1983) that determines the use of administration performance indicators in research. From an open systems theory perspective, the concentration on the “must-haves” of legal compliance suggests that the strength of the institutional pressures and prescriptions from the system environment makes organizations assess their adherence to these prescriptions in administration performance measurement. However, solely measuring adherence to law and regulation is a shortcoming, as firms’ institutional environments involve more than just regulatory expectations and requirements. For example, (Peery, 1975) suggests that the function of the administration component (i.e., goal definition, coordination, and control) is directly connected to the consideration of standards. This points to the importance of integrating compliance with other mimetic (e.g., adherence to voluntary social standards by peers) and normative (e.g., professionalization in implementing sustainability management and monitoring systems) requirements beyond regulatory pressures. For instance, the influence and inclusion of culture and cultural values in social performance measurement and decision-making are scarcely found in existing research (Pizzirani et al., 2014). Another opportunity for future researchers lies in investigating the influence of differences in the national business systems along supply chains (beyond regulatory coercive pressures) on system-wide performance measurement. To achieve this, researchers can build on the conceptualization of “implicit” versus “explicit” orientations of corporate social responsibility (Matten & Moon, 2008).

Proposition 1a: As institutional pressures and prescriptions from the external system environment increase, the likelihood to measure adherence to these institutional prescriptions increases as well.

Proposition 1b: Coercive institutions currently determine administration and governance performance measurement, resulting in the narrow assessment of organizational compliance with law and regulation.

Overall, the administration and governance of the isolated business organization within a supply chain is primarily determined by coercive institutional pressures from the external system environment. However, when moving beyond the isolated focal firm perspective toward a systemic and supply chain-wide perspective, coercive external institutions appear to be less important factors that determine social performance measurement. Instead, the stakeholder salience perspective (Mitchell et al., 1997) becomes a more important factor that bridges the gap between the organizational governance and supply chain (i.e., system components related to inputs, transformation processes, and outputs) levels of my conceptual framework.

3.5.2. Input performance measurement

From a supply chain perspective, stakeholder salience explains the drivers for assessing the consumption of inputs by firms along the supply chain. Researchers focus on conduct toward suppliers, especially on promoting social responsibility among suppliers by monitoring suppliers' compliance with human rights and codes of conduct (e.g., Čuček et al., 2012; Gualandris et al., 2015). (Seuring and Müller, 2008a) argue that supply chain management for sustainable products requires focal firms to increase cooperation with suppliers. Increasing cooperation with suppliers includes improving suppliers' facilities and processes to procure product materials that meet human rights standards and expectations. A focal firm's supply chain management for sustainable products depends on the environmental and social capabilities of its suppliers to meet human rights standards (Varsei et al., 2014). Therefore, the suppliers are in control of providing a critical resource for the focal firm (i.e., social responsibility and capabilities to supply product materials that meet human rights standards). This gives suppliers a certain level of power over the focal firm. (Hillman, Withers, and Collins,

2009) suggest that firms manage dependence by reducing suppliers' power over them (i.e., control of critical resources), while simultaneously increasing their own power over suppliers. The notion of "power" in resource dependence thinking (Pfeffer & Salancik, 1978) can be linked to stakeholder salience thinking (Mitchell et al., 1997), arguing that the power of stakeholders to enforce legitimate and urgent claims is crucial to ensure that organizations pay attention to stakeholders. Transferring these arguments to my results implies that the current goal of input performance measurement is assessing the interdependencies between firms and suppliers to increase firms' control over their salient suppliers.

From an open systems theory perspective and subsequent resource dependence thinking, these issues imply that researchers have a rather incomplete and limited understanding of how to comprehensively assess the access to critical (material, immaterial, and human) resources within the entire system environment. For example, neglecting hiring practices and employee contracts is a deficiency, given that researchers do not only assess CSP in industrialized countries where these issues are regulated and enforced by strict laws, but globally in countries with weaker regulations on these issues. With regard to the neglect of public acceptance measures, it seems that legitimacy theory thinking (Suchman, 1995) has yet to find its way into social performance measurement. Since social accounting is responsible for all providers of important resources, including investors, employees, customers, and communities (Harrison & Van der Laan-Smith, 2015), a research implication is to investigate the drivers and barriers determining a more balanced social assessment of inputs and resources provided by firms' stakeholders.

Proposition 2a: As the power and salience of suppliers increases, the likelihood to monitor social performance of these suppliers increases as well.

Proposition 2b: Current input performance measurement is determined by a high salience of human rights issues at suppliers.

3.5.3. Process performance measurement

After assessing performance related to the consumption of inputs, the second supply chain stage of my framework addresses the transformation of inputs through reconfiguration processes at the focal firm. In general, there is a broad consensus on social indicators used to assess the processes of input reconfiguration and transformation through the workforce. These indicators primarily assess employment (e.g., Devika et al., 2014; Mota et al., 2015), and equal opportunities including fair salary (e.g., Chou et al., 2015; Martinez-Blanco et al., 2014). It is surprising, though, that only worker-related issues seem to be broadly accepted, whereas the academic opinion is divided regarding the inclusion of the interests of other stakeholder groups in assessing social performance. (Mitnick, 2000) argues that firms are more likely to assess social performance when there is a broad public consensus on particular issues, and when they face highly salient stakeholders who express legitimate concerns with great urgency and have the power to enforce their claims (Mitchell et al., 1997). Given the importance of worker issues in my sample and in open systems theory (Jackson, 1988), I refine Mitnick's (2000) original hypothesis and propose that the process component is currently characterized by a general consensus on the high salience of worker interests. Despite the coherence on particular worker interests, future research needs to validate if these issues completely comprise process performance or if additional indicators are needed. Only few attempts have been made in extant research to assess other issues associated with the process component such as disciplinary practices (Chardine-Baumann & Botta-Genoulaz, 2014), personnel fluctuation (Lehmann et al., 2013), or job automation (Basurko & Mesbahi, 2014). Therefore, future research can elaborate whether the social indicators currently agreed upon comprehensively capture the salience of worker interests.

Proposition 3a: As the salience of worker interests increases, the likelihood to assess these work related aspects increases as well.

Proposition 3b: Current process performance measurement is determined by a broad consensus on a high salience of worker interests; particularly employment, equal opportunities, and fair salary.

3.5.4. Output performance measurement

Following the consumption and transformation of inputs, the final supply chain stage of my framework addresses the emission of outputs to external stakeholders. Researchers often assess the outputs resulting from a firm's activities in terms of local community engagement and investments (e.g., Govindan, Khodaverdi, & Jafarian, 2013; Kudla & Klaas-Wissing, 2012) and attributes of final products (e.g., functionality, ergonomics, or durability; Chou et al., 2015; Schmidt et al., 2004). According to the open systems theory, outputs represent a firm's intention to exert influence on its substantial (i.e., salient) environment in order to secure (in a cyclical sense) the provision of future inputs in the long term (Lowe & Tinker, 1977). Since research places the interests of local communities, customers, and consumers at the center of assessing output performance, I propose that output performance measurement is currently determined by a high salience of these stakeholder groups. The focus on these stakeholders suggests that output performance measurement aims at preventing negative reactions to secure local acceptance of organizational conduct and to secure the future inflow of financial resources through selling products.

Proposition 4a: As the salience of local communities, customers, and consumers increases, the likelihood to assess impacts on their interests increases as well.

Proposition 4b: Current output performance measurement is determined by a high salience of local community engagement and investments, as well as customers' and consumers' interests in attributes of final products.

3.5.5. Outcomes performance measurement

The social indicators captured within the previous system components describe situational features and attributes along the supply chain that are objectively verifiable and thus (relatively) easy to assess. Indicators assessing outcomes performance go a step further and aim at answering the subjective “so what?” question (Griffin, 2000), namely why situational features of the previous system components are important to human life and why people care about them (Reitinger et al., 2011). This makes outcomes performance more difficult to assess than the other system components. Outcomes (or impacts) describe how stakeholders (at individual or societal level) actually experience (in a physical, cognitive, or perceptual sense) the social features of the previous system components (Slootweg et al., 2001; Vanclay, 2002). For example, the incidence of child labor is a situational process attribute, whereas the health of working children is a physical outcome (Jørgensen, Lai et al., 2010).

In general, researchers agree on assessing the physical health-related outcomes, mostly addressed through quantifiable indicators such as injuries, fatalities, or disability adjusted life years (e.g., Baumann et al., 2013; Eastwood & Haapala, 2015). However, the integration of more perceptual outcomes such as stakeholder satisfaction is less common. Nevertheless, I find that researchers increasingly integrate subjective experiences and perceptions into outcomes performance measurement. Although the validity of the specific indicators used is debatable as they are often generic (e.g., satisfaction), this points to the increasing importance of the outcomes component in CSP measurement. Overall, however, research still heavily relies on assessing health-related impacts and is only starting to explore other subjective experiences and perceptions in outcomes performance measurement, such as sensory and aesthetic perceptions (e.g., Martinez-Blanco et al., 2014; Santoyo-Castelazo & Azapagic, 2014), or stakeholder satisfaction (e.g., Chou et al., 2015; Tajbakhsh & Hassini, 2015b). A more extensive assessment of the outcomes component implies a shift away from quantitative research methods to more

qualitative research in order to assess stakeholders' inner perceptions of firm performance, which in turn generate stakeholder reactions and feedback.

Proposition 5a: As the consensus on the importance of impacts increases, the likelihood to assess stakeholders' subjective perceptions of these impacts increases as well.

Proposition 5b: Current outcomes performance measurement is determined by a broad consensus on impacts on stakeholders' physical health along supply chains and product life cycles.

Overall, based on the indicators used in research across the input, process, output, and outcomes components, I propose that performance measurement in these components is primarily determined by the high salience of suppliers, workers, local communities, and consumers. Their subjective experiences finally cause feedback and reactions.

3.5.6. Feedback performance measurement

Social performance associated with the feedback system component has not been elaborated in detail by (Mitnick, 2000). By discussing which (and why) social indicators are used for assessing feedback performance, I complete the picture of the intricate linkages between all the system components. Because of the intangible nature of stakeholder engagement (Burchell & Cook, 2008), I find that researchers often marginalize the question of stakeholder feedback, participation, and inclusion in social performance measurement (Mitchell et al., 2015; Williams et al., 2017). In general, researchers often assess issues related to communication with stakeholders, such as the existence of feedback mechanisms, the number of complaints/suggestions for improvement, or the number of consultations with stakeholders (e.g., Arcese et al., 2013; Dale et al., 2013; Lehmann et al., 2013). Although researchers also claim to consider stakeholder inclusion and influence in decision-making (beyond mere communication) on a generic level (e.g., Burritt & Schaltegger, 2014; Gauthier, 2005), only

two papers provide actual quality criteria of stakeholder participation and inclusion (Mathe, 2014; Matos & Hall, 2007). Therefore, I argue that there is a gap in research between the ostensible and generic inclusion of stakeholder voices in performance measurement and the practical and concrete application of feedback performance indicators assessing stakeholder inclusion. This gap between the demand for and the practical application of feedback performance indicators implies a form of symbolic “window dressing” (Weaver, Trevino, & Cochran, 1999) in terms of including stakeholder voices in performance measurement without really assessing how effectively open systems (i.e., organizations) adapt their conduct to stakeholder feedback.

I argue that stakeholder inclusion is largely decoupled (Meyer & Rowan, 1977; Weaver et al., 1999) from social performance measurement research and that the use of social indicators in the feedback component is currently driven by decoupling processes (Tilcsik, 2010). In institutional theory, decoupling aims at maintaining “business as usual,” without adapting practices to pressures from institutions and stakeholders (MacLean & Behnam, 2010). The marginalization of feedback performance indicators impedes researchers and practitioners from adapting organizational performance to a dynamic environment, which ultimately compromises a system’s (i.e., an organization’s) viability (Isaksson et al., 2010; Jackson, 1988).

Therefore, an implication for researchers is to aspire for a more systematic integration of feedback indicators to mitigate decoupling tendencies in social performance measurement. To develop and validate meaningful feedback indicators, management researchers might build on discourse ethics literature and look into the discourse quality criteria set out by (Habermas, 1990) or (Rowe and Frewer, 2000) to assess the quality of integrating stakeholder voices in performance measurement.

Proposition 6a: As subjective and physical outcomes increase, the likelihood increases to assess stakeholders’ feedback and reactions to these outcomes.

Proposition 6b: Current feedback performance measurement is determined by decoupling processes that cause a marginalization of indicators that assess the quality of stakeholder inclusion.

Finally, the feedback component closes the circle twofold. First, communicating with stakeholders to receive their feedback is the starting point to derive relevant indicators, develop performance measurement, and support decision-making (Schaltegger & Wagner, 2006). Receiving feedback helps open systems' governors and managers (i.e., the administration and governance component) to understand and assess the consequences of their decisions which limits deviation from preset goals (Kast & Rosenzweig, 1972). Thus, the open system's behavior can be actively managed instead of waiting passively for reactions from stakeholders. Therefore, the communication with stakeholders to receive feedback can be characterized as an adaptive governance mechanism to inform and support decision making (Williams et al., 2017). Second, beyond the communication with stakeholders, the assessment of the inclusion of stakeholders in decision-making connects the open system with its surrounding system environment. The boundaries of firms are expanding because firms are increasingly involved in interactions with their system environment (Mathe, 2014). Understanding the mutual interactions between firms and their system environment is critical for managers to contribute to sustainability and create value for the system as a whole (Williams et al., 2017). To understand and account for these interactions, (Mitchell, Van Buren, Greenwood, and Freeman, 2015) argue that firms need to intensify the inclusion of stakeholders in social performance measurement and propose that more value is created when organizational decision-making includes and aligns to stakeholders who contribute to the fulfillment of joint purposes. In turn, the inclusion of and alignment to stakeholders drives more complex feedback loops and triggers an iterative coevolution of organizations with their system environment (e.g., by means of sustainability oriented product innovations and business models; Williams et al., 2017).

Proposition 7a: As the assessment of stakeholder communication increases, the likelihood increases that open systems' governors (i.e., organizational decision-makers) adapt social performance measurement and organizational behavior to stakeholders' feedback.

Proposition 7b: As the assessment of stakeholder inclusion increases, the likelihood increases that firms and stakeholders fulfill joint purposes and thus contribute to sustainability and create value for the system as a whole.

3.6. Conclusion

Social performance is an important area in the domain of management and strategy research and consequently, scholars are increasingly striving to achieve a comprehensive understanding and valid measurement of social performance to influence the overarching (sustainable) organizational performance construct. This review and the synthetization of a conceptual framework offer valuable starting points for future research on social indicators.

All 141 reviewed scholarly articles claim to incorporate a life cycle or supply chain perspective, which is based on the open systems theory thinking. I therefore initially expected the social indicators used to span across all performance measurement areas. Instead, I found that only a fraction of the reviewed articles used social indicators addressing all system components. Therefore, I argue that management research lacks a systemic orientation and thus largely neglects the “big picture” of the interrelated factors in business organizations, supply chains, and the external system environment that determine organizational social performance and its assessment. A critical reason for this might be that the majority of the sample is a-theoretical. The fragile theoretical base on which much CSP measurement research is resting is a concern that should be addressed in future research. To strengthen the use of theory, I contributed by developing propositions about the determinants that influence the use of social indicators across all open systems' components. I argue that a holistic evaluation of CSP

integrates all system components. Researchers have continually expressed concern over the lack of systemic considerations in organization and management science. To contribute to the open systems theory thinking in organization and management research, I developed a conceptual systemic framework for a holistic evaluation of CSP (see again Figure 8). The proposed framework serves as a starting point for empirical validation. As another step toward a more coherent understanding of social firm performance, I also contributed by deriving a practical set of social indicators typically used in research along with typical quantitative measurement approaches, the rationale for their inclusion, shortcomings, and recommendations for their future development. This is worthwhile, because a certain consensus is a precondition for establishing a standard set of social indicators. Thus, I provide a starting point and guide to future research and contribute to the scientific discussion about the important social performance dimension in management research.

4. Third study: “From SLCA to positive sustainability performance measurement: A two-tier Delphi study”¹⁶

Summary. Life cycle sustainability assessment (LCSA) currently has a preoccupation with capturing and repairing negative dysfunctions and pathologies instead of fostering positive features that make a human life sustainable and worth living. With the intention to overcome this imbalance, this paper aims at transferring the shift to a positive sustainability performance measurement (PSPM) perspective in industrial ecology.

We argue that positive performance is likely to develop from the lens of social life cycle assessment (SLCA), because sustainability is an anthropocentric concept that puts positive benefits to human well-being (i.e., the social dimension of sustainability) at the center of the

¹⁶ Resubmitted after revision to the Journal of Industrial Ecology (co-authored with Prof. Dr. Rüdiger Hahn). I thank the organizers and participants of the “Hohenheim Revise and Resubmit Seminar in Management and Finance” for their invaluable feedback that substantially improved the study.

analysis. However, the field of SLCA is highly fragmented, without a coherent theoretical understanding and without a clear prioritization of problems and future research directions. Therefore, we engage in an extensive Delphi study with experts from academia and practice to foster a discussion of lessons learned from SLCA for PSPM. In this way, the paper contributes to a more coherent and deeper understanding of both connected fields. The results emphasize that SLCA has become a defensive risk management instrument against reputational damages, whereas PSPM offers the potential to proactively measure and manage positive contributions to sustainable development. We identify three main challenges (definitional, methodological, and managerial) and two main areas of benefits (organizational and societal) and use them to consolidate the debate on SLCA and PSPM and to provide a roadmap for future research.

4.1. Introduction

Life cycle sustainability assessment (LCSA) has become essential in industrial ecology as scholars, regulators, and business organizations increasingly look beyond traditional measurement of financial performance to a more complex integration of performance indicators reflecting the triple bottom line of economic, ecological, and social value (e.g., Blass & Corbett, 2017; DeNisi & Smith, 2014; Richard et al., 2009). However, current approaches primarily report negative burdens or footprints and their reduction during product life cycles and in supply chains (e.g., accidents and fatalities, carbon dioxide emissions, or total cost of ownership) and typically neglect capturing *positive* benefits occurring throughout product life cycles and corporate supply chains (Schaubroeck & Rugani, 2017).

Analogies borrowed from the field of positive psychology (Gillham & Seligman, 1999; Seligman & Csikszentmihalyi, 2000) vividly illustrate why this might be a relevant shortcoming. At the beginning of the new millennium, Seligman and Csikszentmihalyi (2000) pointed to an overemphasis on dysfunctions, pathologies, and their remediation in the field of

psychology. Traditional psychology research was lacking knowledge on the *positive* features that make a human life truly worth living (Gruman, Lumley, & González-Morales, 2017). As a counterbalance, the today widely acknowledged stream of positive psychology aims at shifting “the focus of psychology from preoccupation only with repairing the worst things in life to also building positive qualities” (Seligman & Csikszentmihalyi, 2000, p. 5). With the intention to supplement (not to replace) findings from traditional psychology (Seligman, Steen, Park, & Peterson, 2005), positive psychology strives toward a more complete and balanced understanding of the aspects that contribute to the flourishing and wellbeing of human beings (Gable & Haidt, 2005; Linley, Joseph, Harrington, & Wood, 2006; Lomas & Ivtzan, 2016). Similar thoughts are in order for LCSA that still largely fails to capture sustainability-related value creation, and win-win opportunities providing benefits to organizations and society are not recognized and consequently not realized (Kroeger & Weber, 2015; Lyneis & Sterman, 2016). Instead, management scholars and practitioners tend to have a negative perspective and concentrate on “trying to fix what is wrong” (Luthans, 2002, p. 57). In this paper, we initiate the shift to a positive perspective in LCSA. Analogous to the enrichment of traditional psychology with the lens of positive psychology, introducing new approaches to capture positive benefits (e.g., uptake of pollutants, employment, and human health and happiness) will complement existing (but by themselves incomplete) damage-oriented footprint approaches in LCSA (Schaubroeck & Rugani, 2017).

Despite numerous recent calls for a more intensive engagement in positive sustainability performance measurement (PSPM; Antolín-López et al., 2016; Beske-Janssen et al., 2015; Delmas, Etzion, & Nairn-Birch, 2013; Ekener, Hansson, & Gustavsson, 2016; Pauw, Kandachar, & Karana, 2014; Sala et al., 2013a), only a few researchers have actively engaged in a discussion (Wilhelm et al., 2015). Recently, in this journal, (Schaubroeck & Rugani, 2017) provided a conceptual revision of LCSA and criticized the prevalent “paradigm that mankind

damages the environment.” (p. 8) They argue that damage-focused instruments of LCSA are incomplete “if they do not cover the other side of the coin” (i.e., indicators systems reflecting benefits of human and industrial systems to nature and human well-being; p. 8). Promoting PSPM as this other side of the coin could even help pushing the acceptance of and actual progress to sustainability in business and society (Beske-Janssen et al., 2015).

From an empirical perspective, positive performance is more likely to emerge from the social dimension of sustainability (e.g., Ekener et al., 2016; Vinyes, Oliver-Solà, Ugaya, Rieradevall, & Gasol, 2013) than from the ecological dimension, which mainly focuses on assessing negative impacts, because the ultimate purpose of social actions is to improve people’s well-being (Kroeger & Weber, 2015). Schaubroeck and Rugani (2017) argue that sustainability is an inherently anthropocentric concept, because pursuing sustainability primarily aims at fulfilling human needs and sustaining human well-being. Following this anthropocentric perspective, Schaubroeck and Rugani (2017) put positive benefits to human well-being (i.e., the social dimension) at the center of sustainability assessment.¹⁷ Although social performance measurement approaches, such as social life cycle assessment (SLCA), have the potential to record and display negative and positive performances, such approaches are still in the developmental stage and have to overcome various challenges to become widely accepted assessment methodologies (Ekener et al., 2016). Arcese et al. (2016) conclude that SLCA has become a highly fragmented field without a coherent theoretical understanding and without a clear prioritization of problems and future research directions. Therefore, SLCA is currently

¹⁷ Despite the conceptualization that positive benefits mainly result from the social dimension, PSP can occasionally also arise from the environmental and economic dimensions. For example, the uptake of pollutants from the environment (e.g., carbon dioxide sequestration), or people’s employment (Schaubroeck and Rugani, 2017). However Schaubroeck and Rugani (2017) also argue that the protection and restoration of natural ecosystems and the pursuit of economic prosperity are, in turn, only indirect positive benefits up to the ultimate target of human well-being (i.e., the social dimension of sustainability).

not being utilized to its potential of addressing positive sustainability performance (PSP) throughout product life cycles and corporate supply chains.

Against this background, this paper aims to advance the fields of SLCA and PSPM by providing an overview of the temporal development of core issues, challenges, and opportunities of SLCA and compare them with the core issues of PSPM. We build upon an extensive Delphi study to compile aggregated expert views on both fields to draw lessons for PSPM to prevent the future fragmentation and provide a prioritized research roadmap in both areas. Furthermore, by identifying and prioritizing the core issues that trigger or impede performance measurement, we take a step to overcome the problem of the limited generalization and standardization of PSPM and thus contribute to organizational effectiveness theory. Correspondingly, our research question is the following: What are the past, present, and future core issues of SLCA, and what lessons can be learned for PSPM?

After this introduction, we review relevant literature and introduce the theoretical background of organizational effectiveness theory. Furthermore, by using effectiveness theory as an anchor for our further analysis we contribute to overcoming the prevalent a-theoretical nature of the field (Kühnen & Hahn, 2017). Next, we outline the method of the Delphi study and analyze the results. We then discuss our findings in light of existing literature and organizational effectiveness theory and provide a roadmap for future research. Thus, we contribute by providing a structured and coherent guideline for researchers. Finally, we briefly conclude by emphasizing the most important lessons learned from SLCA for PSPM, as well as the most important implications for theory and practice.

4.2. Theoretical background and relevant literature

Until today, researchers frequently question the ability of existing sustainability frameworks to guide measurement of sustainable effectiveness. Reasons are that such frameworks risk

overlooking the impacts on multiple stakeholders (Gualandris et al., 2015), they lack empirical experience (Baumann et al., 2013), or they are not dedicated to the purpose of assessing and measuring social and sustainability performance during product life cycles and in supply chains (Harik et al., 2014). For example, the United Nations (UN) Sustainable Development Goals (SDGs) represent consensual targets on a global scale and provide concrete long-term objectives for the pursuit of actions toward sustainable development and the fulfillment of human needs and well-being (Schaubroeck & Rugani, 2017). However, although the SDGs provide a potential normative foundation and reference point to capture positive contributions to sustainable development, they are not designed as a performance measurement system to evaluate contributions at organizational or product level (Kühnen & Hahn, 2017). Other frameworks offer a dedicated focus on organizational and product performance such as the Future Fit goals and indicators (Future-Fit Foundation, 2016a, 2016b). However, they lack the consensual and established foundation of the SDGs. Therefore, research on the measurement of social and sustainability performance frequently refers to established sustainability disclosure frameworks (Beske-Janssen et al., 2015), such as the Global Reporting Initiative's (GRI) standards (GRI, 2016) or the Carbon Disclosure Project (CDP) directory (CDP, 2017). However, such frameworks focus on external disclosure instead of guiding internal performance measurement to support decision-making related to sustainability. Other concepts and ideas such as the creating shared value proposition by Porter and Kramer (2011) or the institution of social businesses or B-corporations (e.g., Doherty, Haugh, & Lyon, 2014) are also popular among scholars and practitioners and provide at least a weak link to social and/or positive sustainability performance. However, they are usually not connected to its concrete measurement (Bengo, Marika, Giovanni, & Mario, 2016; Crane, Palazzo, Spence, & Matten, 2014).

Sustainability performance measurement as such can be characterized as the process of collecting, analyzing, and communicating information about desired and undesired sustainability impacts to support internal management decisions. Thus, sustainability performance measurement supports managers in improving the interactions between business, society, and the environment (Maas et al., 2016b). However, research on sustainability performance measurement lacks systems thinking (Taticchi, Tonelli, & Pasqualino, 2013). To integrate systems thinking in sustainability performance measurement, organizational effectiveness theory¹⁸ and especially its functional model provide a valuable perspective, because the functional model characterizes organizational (sustainable) effectiveness as the degree to which an open system (i.e., an organization) fulfills functions to benefit its overarching system environment (i.e., society; Kroeger & Weber, 2015). To fulfill such functions, the functional model assumes that every open system needs to perform four key activities: An organization needs to (1) define its purpose for being and assess goal achievements (goal attainment), (2) adapt to its environment to access resources (adaptation), (3) coordinate its efforts (integration), and (4) reduce strains in and tensions with its environment (pattern maintenance). The crucial question is: Do these activities cause functional or dysfunctional consequences when answering stakeholders' needs (Cunningham, 1977)? Functional consequences change existing conditions in the direction of the desired objectives (meeting of stakeholders' needs; i.e., PSP), whereas dysfunctional consequences change existing conditions in the opposite direction (generation of new needs) and interfere with the achievement of desired objectives (i.e., negative sustainability performance; Cunningham, 1977). In sum, organizational sustainable effectiveness addresses the sustainability-related

¹⁸ For reasons of simplicity, we consider "effectiveness" and "performance" congruent terms (e.g., Mitnick, 2000). Nevertheless, we acknowledge that other researchers distinguish between organizational performance (i.e., economic valuation of financial performance, product market performance, and shareholder return) and organizational effectiveness (i.e., a broader construct encompassing organizational performance, the internal efficiency and effectiveness of operations, as well as corporate social responsibility and corporate sustainability; e.g., Richard et al., 2009).

consequences of organizational activities and how well these consequences serve the needs of organizational stakeholders.

Both industrial ecology and organizational functional effectiveness theory view an organization as an open system that acquires resources from its system environment, utilizes these resources in a conversion process, and produces outputs such as goods and services that are ultimately disposed (Webb, 1974). Therefore, an organization's functional effectiveness results from the consequences occurring during the basic industrial ecology processes (i.e., life cycle stages) of resource acquisition, transformation, emission, and disposal (Connolly, Conlon, & Deutsch, 1980; Molnar & Rogers, 1976). The field of industrial ecology has generated substantial work on sustainability performance measurement. For example, Traverso, Finkbeiner et al. (2012) developed a life cycle sustainability dashboard as a graphical presentation of comprehensive but disaggregated LCSA results to facilitate understanding among managerial decision makers. Similarly, Shuaib et al. (2014) suggested an approach to aggregate a set of product sustainability metrics into a comprehensive product sustainability index. However, despite the critical importance of the social dimension (i.e., human well-being; Schaubroeck & Rugani, 2017) in industrial ecology and LCSA, the assessment of the social pillar by means of SLCA is still at a developmental stage (Kühnen & Hahn, 2017).

The temporal development of the SLCA field dates back to the 1990s. The first peer-reviewed publication by O'Brien, Doig, and Clift (1996) provided a combination of ELCA and SLCA to investigate which social and political factors determine environmental impacts in order to initiate positive changes toward sustainable development. In the following early years, only a few and infrequent efforts were made to further develop the concept of SLCA. Early researchers introduced conceptual frameworks for social life cycle impact assessment (Dreyer, Hauschild, & Schierbeck, 2006), developed social indicators (Schmidt et al., 2004), and demonstrated the applicability of their own approaches in case studies (Hutchins & Sutherland,

2008). The first review by Jørgensen et al. (2008) compares several different approaches to SLCA and highlights a broad variety of methodological issues, especially in the formulation and selection of indicators. Moreover, the authors emphasize the need to reach consensus about the most important impact assessment categories to include in SLCA. Overall, the period from 1996 to 2008 mainly covered the conceptual integration of social aspects into the established framework of ELCA, as well as the general role that SLCA could play to support organizational decision-making (Arcese et al., 2016).

In 2009, researchers pooled their efforts in the Life Cycle Initiative of the United Nations Environment Programme (UNEP) and the Society of Environmental Toxicology and Chemistry (SETAC; Benoît et al., 2010) which culminated in the publication of the guidelines for SLCA in 2009 (UNEP & SETAC, 2009). The guidelines provide a description of SLCA following the conceptual framework and principles of ELCA as defined by the International Standardization Organization (ISO) standard 14040 (ISO, 2006). The guidelines and the connected methodological sheets (UNEP & SETAC, 2013) triggered several empirical articles focusing on application and validation through case studies (e.g., Andrews et al., 2009; Dreyer, Hauschild, & Schierbeck, 2010; Franze & Ciroth, 2011; Macombe et al., 2013; Martinez-Blanco et al., 2014; Musaaazi et al., 2015; Ramirez, Petti, Brones, & Ugaya, 2016; Traverso, Asdrubali, Francia, & Finkbeiner, 2012). Researchers were especially interested in the assessment of social impacts on workers, such as the violation of labor rights (Arcese et al., 2016). For example, Andrews et al. (2009) proposed a life cycle attribute assessment approach to complement traditional ELCA procedures by investigating what percentage of a product's supply chain has a particular social attribute (e.g., provision of basic medical insurance to workers). In sum, research from 2009 to 2016 focused on the case-based testing, validation, and application of SLCA.

Nevertheless, researchers stress that the methodological development of SLCA has not made significant progress so that the implementation in practice is stalling (Martínez-Blanco et al., 2015). For example, Baumann et al. (2013) note their skepticism about the SLCA guidelines because they are more of a common sense-derived framework than an empirically based systematization. Many indicators, such as child labor (see also Jørgensen, Lai et al., 2010), are highly ideological and may be perceived ambiguously in different cultural backgrounds. In a review of the state of the art of SLCA, Arcese et al. (2016) conclude that the field is still highly fragmented without consensus on core issues and research directions.

In a similar sense, PSPM research also faces the danger of fragmentation due to the close relationship with SLCA. Overall, the temporal development of the PSPM field started in the early 2000s with the conceptual introduction of considering positive sustainability aspects to overcome the prevalent and insufficient orientation toward negative sustainability harm, damages, and burdens. Subsequently, conceptual and empirical efforts aimed at proposing indicators and assessment approaches of PSP. However, only few and isolated (but notable) research endeavors intended to establish a theoretical and normative foundation of the field. Therefore, the empirical search for PSP indicators runs into the danger of looking at what can be measured technically, rather than at what should be measured normatively. Consequently, the few recent reviews and synthetizations of the literature note that research, so far, addressed PSPM only as a marginal side topic, although it recently receives increasing attention (Di Cesare et al., 2016). Overall, the literature points to inconsistencies in the operationalization of PSP and stresses the need to define the characteristics and constituents of PSP before developing indicators and assessment approaches. Table 7 provides an overview of key contributions to extant PSPM research.

Table 7. Overview of key references in extant PSPM research

Contribution to PSPM	Key References	Main findings and implications in terms of PSPM
Conceptual introduction and development of PSPM related approaches	<p>George (2001); Hart and Milstein (2003); Luthans (2002)</p> <p>Benöit et al. (2010); Gibson (2013); Haupt, Vadenbo, and Hellweg (2017), Norris (2006, 2013), Pauw et al. (2014), Sala, Farioli, and Zamagni (2013, 2013), Schaubroeck and Rugani (2017); Xia, Zu, and Shi (2015)</p> <p>Neugebauer et al. (2014); Schaltegger and Burritt (2014)</p> <p>Hacking and Guthrie (2008); Jørgensen et al. (2010) Jørgensen et al. (2010)</p>	<p>Early key references on PSPM criticize management scholars’ and practitioners’ ambition to deliver positive contributions to sustainable development for their negative perspective on sustainable development (e.g., as a necessary and costly evil to maintain legitimacy) → Scholars and practitioners merely try to fix what is wrong by reducing unsustainable issues.</p> <p>From around 2005 on, first noticeable contributions introduce concept of benefits and PSP into performance measurement and LCSA research:</p> <ul style="list-style-type: none"> • Life cycle attribute assessment to estimate the potential health benefits resulting from economic activities. • “Handprint” assessment to evaluate product benefits as opposed to “footprint” assessment to evaluate damages. • Benefits or positive impacts can play major role in SLCA, compared to their marginal role in current ELCA. • Generic aspects to measure PSP suggested (e.g., establishment of a circular economy). <p>Few authors propose more concrete frameworks and indicators that aim at delivering a positive transition to sustainability:</p> <ul style="list-style-type: none"> • Elaboration of cause-effect relation between payment of fair wages and level of education, which positively or negatively affect human well-being. • Proposition of indicators of efficiency, consistency, and sufficiency to contribute to a sustainability transformation of markets and society. <p>Critical perspective points to problems when characterizing performance as positive or negative:</p> <ul style="list-style-type: none"> • Impacts are not consistent across cultures, and involve subjective and dynamic value judgements. • Validity of existing indicators can be criticized, because impacts are presently examined and assessed based on opaque and preconceived ideological principles (e.g., child labor).

Table 7. Continued

Theoretical and normative foundation	Kroeger and Weber (2015); Lyneis and Sterman (2016); Reitinger, Dumke, Barosevic, and Hillerbrand (2011)	<p>After first decade of the 2000s, a few isolated studies attempt to develop a theoretical and normative foundation for PSPM:</p> <ul style="list-style-type: none"> • Evaluation of performance as positive or negative: Amartya Sen's capabilities approach to define (positive and negative impacts on) elements that are important in a human life. • Modelling of societal benefits: Functional model of organizational effectiveness theory defines effectiveness as degree to which organizations benefit their surrounding communities and society. • Achieving mutual benefits between organizations and society: Theory of capability trap explains obstacles in realizing win-win opportunities that improve organizational performance while simultaneously benefiting society.
Case and experience studies	Delmas et al. (2013); Mattingly and Berman (2006); Minor and Morgan (2011); Strike et al. (2006)	<p>Several researchers find that positive and negative sustainability performance are empirically distinct constructs:</p> <ul style="list-style-type: none"> • Avoiding and reducing negative sustainability burdens is not the same as delivering benefits that positively contribute to sustainability. • Aggregation of negative and positive sustainability performance into a single index leads to misinterpretation.
Review and synthesis of extant literature	Baumann et al. (2013); Corona, Bozhilova-Kisheva, Olsen, and San Miguel (2017); Ekener et al. (2016); Ekener-Petersen and Moberg (2013); Vinyes et al. (2013); Wilhelm et al. (2015)	<p>Empirical research begins to intensify efforts of assessing PSP based on product case studies (including airbags, cooking oil, laptop computers, mobile phones, vehicle fuels, and solar power generation).</p>
Review and synthesis of extant literature	Antolín-López et al. (2016); Beske-Janssen et al. (2015); Di Cesare et al. (2016)	<p>A few recent literature reviews marginally pick up the idea of PSP when analyzing and synthesizing the field:</p> <ul style="list-style-type: none"> • Call for a concentration of win-win situations when measuring supply chain sustainability performance. • Inconsistencies in terms of positive and negative operationalization of sustainability indicators. • Measuring indicators in either positive or negative terms suggested to avoid misinterpretation. • Need for a clear definition of what constitutes PSP and call for a consensus on corresponding positive indicators.
This study		<p>Offers a structured and coherent understanding of (currently isolated and scattered) core challenges and opportunities of SLCA and PSPM:</p> <ul style="list-style-type: none"> • Overview of extant literature on measuring and managing positive sustainability benefits. • Revelation of lessons learned from SLCA for PSPM. • Elaboration how core challenges and opportunities of the field determine organizational effectiveness. • New positive perspective in sustainability assessment and management.

This brief review illustrated various challenges and opportunities for SLCA and PSPM across several relevant literature strands. What is still missing, however, is a coherent and systematic identification and prioritization of the core issues of SLCA and PSPM. Thus, the remainder of this paper prioritizes the core issues and research needs to consolidate efforts in SLCA and PSPM based on insights from an extensive Delphi study.

4.3. Method

As elaborated, the field of SLCA is highly fragmented and researchers have addressed isolated questions without a coherent research direction. PSP largely results from the social dimension of sustainability so that the field of PSPM also faces the danger of fragmentation. Thus, we chose the research approach of a Delphi study to gain an overarching perspective by gathering a panel of experts. The Delphi method aims at structuring a group communication process in which a group of individuals deals with a complex problem (Linstone et al., 2002). It is an anonymous, iterative multi-round survey process, in which the moderator provides feedback of the group opinion to the participants after each round (Linstone et al., 2002). In our case, the approach allows identifying and aggregating various expert opinions to reach a more unified understanding of the SLCA and PSPM fields. Schmidt (1997) outlines a structured approach for conducting a Delphi study. We adapted this structure and opted for a two-pronged Delphi study dealing with the measurement of social performance, as well as PSP by drawing on the same pool of experts to achieve a consolidated picture of the core issues in the two inherently connected fields. We invited all experts from the overall pool to participate in the SLCA and in the PSPM questionnaires, respectively.

We adhered to Okoli and Pawlowski's (2004) guidelines for a rigorous process for selecting experts. According to the best-practice example of conducting a Delphi study by Sutterlüty et al. (2017) in this journal, the primary criterion for identifying and selecting experts is their

knowledge and experience in a particular field. Consequently, we selected experts with substantial experience in SLCA, sustainability assessment, and sustainability management (see Appendix III for an overview of the expert participants' characteristics from the final round of inquiries as illustrated below). We contacted academic researchers, corporate practitioners, and other experts from civil society to ensure a broad range of expert experience from practice and academia. Initially, 54 company experts and 40 experts from civil society were approached mostly through personal contacts¹⁹. Furthermore, we identified 251 international researchers from publications that were previously investigated in a systematic literature review published in this journal (Kühnen & Hahn, 2017). Thus, especially the selection of academics followed a much more rigorous process compared to the typical expert selection in other Delphi studies while the selection of practitioners followed generally accepted procedures (e.g., Paré, Cameron, Poba-Nzaou, & Templier, 2013; Seuring & Müller, 2008b). The two parallel inquiries on SLCA and PSPM each involved three rounds of online survey questionnaire (see Table 8).

¹⁹ The two authors of this paper and the other members of the "Handprint" research project compiled a list of personal contacts to identify company representatives and other experts with experience in SLCA, sustainability assessment, and sustainability management. The project was funded by the German Federal Ministry of Education and Research (grant number: 01UT1422C).

Table 8. Data collection process of the Delphi study

Rounds	Content of rounds	Overall pool of 345 experts	
		No. of participants in SLCA Delphi	No. of participants in PSPM Delphi
R1	Open question asking for the most important challenges and opportunities for measuring social performance and PSP along product life cycles and corporate supply chains. Moderators: Content analysis to consolidate the open responses into several items.	89	57
R2	First rating of importance of items. Moderators: Aggregation of ratings and ranking of items (sorted by the mean values and standard deviations of ratings in descending order).	49 (five-point-scale)	31 (seven-point-scale)
R3	Final rating of importance of items. Moderators: Final ranking of items (sorted by the mean values and standard deviations of ratings in descending order) to determine their relative priority.	26 (nine-point-scale)	27 (nine-point-scale)

Note. During round two, we realized a central tendency of ratings, so that we opted to broaden the rating scale to achieve more differentiated results. Due to the central tendency, we recognize that the ratings may not provide the highest possible estimate of objective reality. However, they reflect the general perception of experts with knowledge and experience in the measurement of social performance and PSP. Decreasing participation is typical in Delphi studies due to the inherent multiple iteration processes (Paré et al., 2013). Furthermore, participation often decreases if the size of a large pool of participants prevents establishing a personal pre-contact with the individual experts (Seuring & Müller, 2008b).

Of the 345 experts contacted for the first round of the SLCA inquiry, 89 completed the questionnaire (a response rate of about 26%). The first round started with open qualitative questions asking what are the most important challenges and opportunities for measuring social performance during product life cycles and in corporate supply chains? The rationale behind this question was to ensure that the participants answered with a life cycle perspective in mind, because sustainability assessment and performance measurement assessment should generally take a life cycle perspective as a standard (Schaubroeck & Rugani, 2017). Thus, the participants were asked take the system boundaries typically addressed in SLCA (i.e., the general stages of

supplying commodities and services, product manufacturing, transport and distribution, use, and disposal; e.g., Dreyer et al., 2006) into consideration when thinking about core challenges and opportunities of SLCA. Respondents were free to provide as comprehensive open narrative descriptions as they considered relevant. After this brainstorming round, we used qualitative content analysis (Mayring, 2010) to inductively (Seuring & Gold, 2012) evaluate and code the open survey responses into recurring challenges and opportunities. We consolidated the open responses into a list of several items (i.e., challenges and opportunities of SLCA).

In the second round, 49 of the 89 participants from round one completed the questionnaire (response rate ~55%). We asked the experts to quantitatively rate the importance of each item on a five-point scale ranging from not at all important (=1) to extremely important (=5). Furthermore, the experts could provide additional comments on the list of items to verify whether the items accurately represent the experts' ideas (see Schmidt, 1997). We aggregated the ratings of each respondent into a group response by calculating the mean values and standard deviations of each item. For the third and final round, 26 of the remaining 49 participants completed the questionnaire (i.e., 18 academics, 6 business practitioners, and 2 other experts; response rate ~53%). Here, we presented the aggregated group response (ordered by the mean values and standard deviations in decreasing order) and asked the participants to rate the importance of each item on a nine-point scale (for a broader spread of ratings compared to the previous round) ranging from not at all important (=1) to extremely important (=9). Again, additional qualitative comments on the core issues in SLCA were possible.

In the PSPM inquiry, we followed the same procedure as just illustrated for the SLCA inquiry. The first brainstorming round started with the open qualitative questions of what are the most important challenges and opportunities for measuring positive sustainability benefits during product life cycles and in corporate supply chains? By integrating the life cycle perspective into this first question, we aimed to transfer the system boundaries typically

addressed in SLCA into the participants' mind-set when thinking about to core challenges and opportunities PSPM. After again inductively coding and consolidating the open responses into several items, we asked the participants to quantitatively rate the importance of each item on a seven-point scale in the second round. In the third round, we presented the aggregated group response and asked for a rating of the importance of each item again on a nine-point scale. 57 of the 345 experts participated in the first round (about 17%), 31 of the 57 in the second round (about 54%), and 27 of the 31 in the final round (i.e., 18 academics, 5 business practitioners, and 4 other experts; final response rate of about 87%). In each round, the participants had the opportunity to provide additional qualitative comments on core issues in PSPM.

As can be seen from this overview, this study combines inductive and deductive reasoning to develop structural dimensions (analytical categories) for classifying and analyzing the collected data material. With an inductive approach, the structural dimensions emerge from the material under investigation. With a deductive approach, the structural dimensions are selected before the material is analyzed, based on existing analytic frameworks (i.e., based on existing theory; Duriau, Reger, & Pfarrer, 2007; Seuring & Gold, 2012). Employing a dual logic in this research, we first used an inductive approach to code and consolidate the experts' open answers into a list of items between the first and second round of the Delphi study (as described above). Inductively grouping the identified and prioritized items under more abstract headings that emerged from a discussion of the interrelations between the challenges and opportunities for SLCA and PSPM led to five major structural dimensions that provide a more coherent and deeper understanding of the fragmented field. For the final discussion of the results, we opted for a deductive approach referring to the four organizational activity categories from the functional model of organizational effectiveness theory as analytical lens. Thus, we elaborated how the challenges and opportunities of SLCA and PSPM impede or contribute to organizational effectiveness.

To ensure the objectivity of the study, we adhered to the structured approach described above and documented every step. We addressed reliability by including both authors in the overall data analysis (including the inductive coding of open responses into items between the first and second round). Sending the results back to the Delphi participants after each round inherently contributes to the validity of a Delphi study and is regarded as an inherent strength of the method (Okoli & Pawlowski, 2004). Furthermore, the Delphi approach has been proven as a valid option to investigate methodological issues in sustainability assessment approaches that are developmental (i.e., SLCA) and unexplored (i.e. PSPM; Sutterlüty et al., 2017). Nevertheless, the two-pronged Delphi approach has certain limitations. The selection of experts may be considered a limitation as there are certainly more experts we could not identify. However, the overall sample of 345 experts was highly qualified and generally willing to participate. While the seemingly low number of active participants might be perceived as another limitation, a panel size of between ten and thirty participants is common practice in Delphi-based research (Paré et al., 2013; Worrell, Di Gangi, & Bush, 2013) so that the number of experts who actively participated in our inquiry is at the upper margin. Nevertheless, the sample size restricts the explanatory power of the statistical evaluation to descriptive results that depend on the further interpretation of both authors as it is common in Delphi studies. The sample and the response rates among the three participant groups indicate a certain bias toward academics. Especially for practitioners, a lower response rate is typical in Delphi studies (e.g., Seuring & Müller, 2008b). Therefore, the practical managerial value of the results of this study might be skewed in favor of more abstract, scholarly, and theoretical implications. Furthermore, we do not claim that these findings can be transferred to other research settings.

4.4. Results

The inductive coding of the qualitative answers in the first round resulted in the challenges and opportunities for SLCA and of PSPM listed in Tables 9 and Table 10. Overall, the experts

associated more challenges than opportunities with SLCA and vice versa with PSPM. We analyzed the interrelations of the challenges and opportunities between SLCA and PSPM and grouped the items to abstract topics as presented in the following in more detail (see Appendices IV and V for a complete overview of the experts' ratings of challenges and opportunities of SLCA and PSPM during the second and third Delphi rounds).

Table 9. Challenges of SLCA and PSPM

Challenges of SLCA		Challenges of PSPM	
Items aggregated in first round	MV (SD) of experts' assessments from final round on nine-point-scale	Items aggregated in first round	MV (SD) of experts' assessments from final round on nine-point-scale
Definitional challenges			
• Complexity of social and cultural issues	6.96 (1.93)	• Reaching consensus on what constitutes a positive benefit	6.80 (2.30)
• Lack of consensus on social indicators*	5.33 (1.69)	• Setting a universal benchmark to evaluate what is positive or negative	5.36 (1.83)
• Limited regulation	4.11 (1.93)		
Methodological challenges			
• Limited availability of data	6.67 (2.30)	• Problems of data collection about positive benefits	6.16 (1.80)
• Complexity of supply chains	5.78 (1.91)	• Differing development stages of assessment methodologies between the three sustainability dimensions	4.28 (1.54)
• Lack of consensus on social indicators*	5.33 (1.69)		
• Lack of technical know-how of social assessment methods	4.48 (1.76)		
Managerial challenges			
• Lack of management commitment	5.56 (2.17)	• Assessing positive benefits requires long-term thinking	7.08 (2.50)
• Costs of social assessments	4.48 (1.72)		
• Time requirement of social assessments	4.41 (2.04)		
Other			
• Limited market incentives	5.52 (2.08)	• Treatment of trade-offs (offset) between positive and negative impacts	5.96 (1.37)
		• Uncertainty how one product may positively/negatively influence another product	4.72 (1.61)
		• Changing the current established perspective from reducing negative issues to generating positive benefits	3.44 (2.12)

Note. Items are prioritized by the mean values (MV) and standard deviations (SD) of ratings from the third and final round (R).

* Item included in two categories because the past methodological development of social indicators preceded the definitional and normative consensus on what to measure with the indicators.

Table 10. Opportunities of SLCA and PSPM

Opportunities of SLCA		Opportunities of PSPM	
Items aggregated in first round	MV (SD) of experts' assessments from final round on nine-point-scale	Items aggregated in first round	MV (SD) of experts' assessments from final round on nine-point-scale
Organizational benefits			
• Firm reputation and brand image	7.33 (1.69)	• Support of internal decision making	5.12 (1.37)
• Support of risk and compliance management	6.89 (1.83)	• Support of external communication	4.48 (2.12)
• Establishment of long-term collaborative relationships	5.89 (1.69)		
• Building of innovation capacities	5.48 (2.49)		
• Frontrunner effects through a proactive stance towards social assessment	5.26 (2.26)		
• Profit and financial performance	3.93 (2.32)		
Societal benefits			
		• Contribution to a complete picture of sustainability performance	7.20 (1.67)
		• Contribution to long-term thinking	7.04 (2.18)
		• Contribution to the internalization of (external) environmental and social costs	6.24 (1.84)
		• Motivation for sustainability improvements	6.04 (1.34)
Other			
		• Clear demonstration of trade-offs	5.68 (1.76)
		• May change the ranking among different product/investment/sourcing alternatives	4.88 (1.11)
		• Dealing with positive benefits may be a better psychological driver towards sustainable development than dealing with negative issues	4.56 (1.39)
		• Assessing positive benefits may increase the willingness to assess negative issues as well	3.16 (1.95)

Note. Items are prioritized by the mean values (MV) and standard deviations (SD) of ratings from the third and final round (R).

Regarding the challenges, the first major topic deals with definitional challenges. The Delphi experts highlighted the complexity of social and cultural issues (mean value (MV) 6.96) that impede reaching consensus on what generally constitutes social performance and what constitutes positive sustainability benefits (MV 6.80) across cultural backgrounds.

Interestingly, however, the lack of consensus on social indicators (MV 5.33) was considered only a moderate challenge. This implies that the experts believed that social performance can already be measured technically, although they did not agree on what should be measured normatively. Nevertheless, the Delphi participants tended to refuse the potential guidance of normative institutions, as they considered regulation (MV 4.11) or other (universal) benchmarks (MV 5.36) as not fully adequate to define what is (normatively) important when measuring social performance and PSP.

The disparity between the normative foundation and the technical methodology of performance measurement leads to the second major topic of challenges when conducting SLCA and PSPM. As indicated above, the Delphi participants considered the lack of consensus on social indicators a moderate challenge (MV 5.33) which deviates substantially from extant literature as will be discussed in the following section. Similarly, the Delphi experts regarded the lack of empirical experience and thus the lack of expertise in social assessment methodologies only a minor challenge (MV 4.48). Additionally, they found the differing developmental stages of assessment methods between the sustainability dimensions as a modest challenge (MV 4.28). Regarding the provision of relevant data, the Delphi panel and extant research agreed on the highly challenging issues of limited availability of data for SLCA (MV 6.67) and problems of data collection for PSPM (MV 6.16). From an organizational effectiveness perspective, the life cycle orientation and the complexity of supply chains (MV 5.78) pose a particular problem because data during the entire life cycle are often not available.

The third major topic identified in the data is related to managerial challenges that impede the implementation of SLCA and PSPM in managerial decision-making. The Delphi experts regarded the potential lack of management commitment (MV 5.56) as a moderate challenge and even perceived the costs (MV 4.48) and time requirement (MV 4.41) as rather minor challenges. Therefore, we argue that current managerial practice seriously attempts to embed

social performance and PSP in organizational decision-making. However, despite potential efforts to implement SLCA and PSPM, the Delphi experts emphasized the significant challenge that especially PSPM requires long-term thinking (MV 7.08) from managers.

Apart from these three overarching topics on challenges, the data also revealed two top-level opportunities for SLCA and PSPM. Whereas the previously discussed challenges span SLCA and PSPM, the opportunities and benefits are more specific to each approach. First, organizational benefits emanated from the experts' answers mainly for SLCA. The Delphi panel indicated only a minor to modest relationship between social performance (measurement) and financial performance (MV 3.93). However, the Delphi participants emphasized the usefulness of SLCA for the support of risk and compliance management (MV 6.89) to protect firm reputation and brand image (MV 7.33) as another clear business case of SLCA. Interestingly in this regard, only a moderate influence of SLCA on the establishment of long-term collaborative relationships with value chain partners (MV 5.89), which can be labeled a potential means of risk reduction, was indicated in the study. The Delphi panel believed SLCA also only moderately contributes to the building of innovations capacities (MV 5.48), for which long-term collaboration can be regarded as a key factor. Consequently, SLCA is currently not utilized to its potential of generating and communicating knowledge about components, ingredients, and working conditions during product life cycles. As a result, it is difficult for organizations to realize frontrunner effects through a proactive stance toward SLCA (MV 5.26). Similarly, the Delphi panel points to the (yet) moderate potential of PSPM to generate information to support internal decision making (MV 5.12) and external communication (MV. 4.48). However, because PSPM is a new concept, this evaluation might change in the future after systematically developing PSPM and testing its usefulness in research and organizational practice.

Second, beyond this organizational perspective, societal benefits were identified as topic of opportunities specifically for PSPM. The Delphi experts believe that PSPM can become an instrument for capturing the contribution to a sustainability transformation as they rate the chance that PSPM can trigger and motivate sustainability improvements high (MV 6.04). One way of achieving a transformation into a sustainable society and economy is to internalize the external environmental and social costs (externalities; MV 6.24) emerging from current production and consumption patterns. Another way of contributing to a sustainability transformation is to incorporate a long-term orientation into performance measurement. The Delphi panel experts quite firmly believed that the development of PSP measures would contribute to long-term thinking (MV 7.04) in performance measurement and management in the future. Ironically, they also considered the current lack of long-term thinking the biggest challenge for developing PSPM (MV 7.08; see again Table 9). What seems to be a paradox at first sight might actually be a signal of a changing attitude in research and managerial practice from short-termism to long-term considerations through (positive) performance measurement. Overall, the development of PSPM offers the chance to contribute to a more complete picture of sustainability (MV 7.20) by incorporating negative and positive performance measures that balance short-term and long-term sustainability performance. Thus, PSPM would go beyond the identification of roadblocks on the way to sustainability and become an instrument for measuring and achieving actual progress toward sustainable development. However, there is the danger that PSPM becomes a catch-all instrument for every conceivable topic and thus would be neither practical nor relevant for scholars and practitioners.

4.5. Discussion of implications for research and theory

This Delphi study extends previous research on SLCA and PSPM by providing a more aggregate picture of a currently fragmented field. Now, we turn to a discussion of the results in light of organizational effectiveness theory. The functional model of effectiveness assumes that

every open system (i.e., organization or product system) must define its purpose for being and measure its sustainability achievements (goal attainment), adapt to its resource environment (adaptation), coordinate its efforts (integration), and reduce strains in its environment (pattern maintenance). The crucial question to be answered is whether these activities cause functional or dysfunctional consequences when answering stakeholders' needs (Cunningham, 1977). Therefore, from a scholarly perspective, we now discuss whether and how the challenges and opportunities of SLCA and PSPM act as barriers and drivers for these four activities of functional effectiveness and how they influence functional effectiveness of organizations and product systems. Furthermore, we explain how these insights can assist practitioners' decision-making.

4.5.1. Goal attainment

In terms of goal attainment, the functional model assumes that an organization is effective if it defines appropriate goals to serve business and societal needs, and if the organization develops adequate measures to assess progress in meeting these needs. The Delphi results indicate that SLCA is driven by the goal to protect and enhance firm reputation and brand image, whereas PSPM is primarily driven by the goal to provide a more complete picture of sustainability performance. Thus, SLCA aims to serve more business-oriented needs. This result deviates from the typical proposition that SLCA aims at supporting management in improving the conditions in product life cycles to meet social needs (e.g., Benoît et al., 2010). The results imply that the role of serving societal needs is instead more firmly positioned in PSPM. From a definitional perspective, the most fundamental basic barrier that impedes the attainment of these functional goals identified in our study is the disagreement about the definition of social performance and PSP and the corresponding indicators. Until today, researchers are divided about whether performance results from an efficiency perspective by avoiding or reducing negative and unsustainable issues or footprints (e.g., Minor & Morgan,

2011), from a compliance perspective by evaluating performance that goes beyond compliance with regulations or standards (e.g., Di Cesare et al., 2016), or from an actual effectiveness perspective by evaluating the degree to which organizations actively benefit society and help stakeholders meet their needs (e.g., Kroeger & Weber, 2015).

This disparity in the general definition of performance extends to the development and selection of indicators. One fraction of researchers continuously emphasizes the problem of a lack of consensus about a general set of relevant indicators (e.g., Boukherroub et al., 2015; Hubbard, 2009). Other researchers argue that the challenge is not the lack of suitable indicators but rather the lack of a transparent and legitimate selection process to agree on the most adequate indicators (e.g., Lehmann et al., 2013; Neugebauer et al., 2015). Baumann et al. (2013) argue that general methodological rules (e.g., for the selection of indicators) need to be based on extensive empirical case study experience. However, current frameworks such as the SLCA guidelines (UNEP & SETAC, 2009, 2013) are not (yet) completely applicable to case studies (Lehmann et al., 2013; Martínez-Blanco et al., 2014) to sufficiently generate empirical experience. Thus, extant literature frequently stresses that the development of SLCA approaches is lagging behind environmental and economic measurement approaches (e.g., Martínez-Blanco et al., 2015; Searcy, 2012). These differing developmental stages impede efforts to integrate social, ecological, and economic performance measures holistically (Hoogmartens et al., 2014).

This suggests that, in the mid-term, performance measurement first needs to succeed in a simultaneous (but separate) consideration of positive and negative social, ecological, and economic measures to assess goal attainment. Such a new mid-term goal could guide researchers and practitioners to contribute to the alignment of the differing maturity levels of the LCSA elements (i.e., ELCA, LCC, and SLCA including positive and negative aspects). Thus, research and practice could develop an established consensual foundation of parallel

social, ecological, and economic measures before achieving a truly holistic sustainability integration of (positive and negative) performance measures in the long-term. For example, Salvado et al. (2015) argue that the three dimensions of sustainability are most informative when they are analyzed separately, while Beske-Janssen et al. (2015) note that focusing on one sustainability performance dimension (or its relationships to only one of the other two) would reveal insights otherwise overlooked. This, in turn, speaks against the development of sustainability indices that blend measures of the three sustainability dimensions into an ostensibly holistic foundation for decision-making. Currently, managers are thus advised to make and justify decisions based on systematic indicator systems that simultaneously and separately display individual sustainability indicators. They would then have a transparent and comprehensible system of levers at their disposal, which they can pull to reduce unsustainable issues and improve sustainability benefits for business and society.

4.5.2. Adaption

Regarding organizational adaption to the environment, the functional model assumes that an organization is effective if it is able to match its behavior with environmental requirements to secure the access to critical resources needed to achieve organizational goals. Ortiz-de-Mandojana and Bansal (2016) argue that organizations with the ability to identify, process, and adapt to environmental signals and risks over a longer time show better resilience to external changes, and thus have better chances of survival. The insights of our study indicate that SLCA supports defensive risk management considerations to secure organizational legitimacy (Suchman, 1995) granted by society against reputational risks. Thus, the original purpose of SLCA to proactively promote social benefits (e.g., Benoît et al., 2010) might be superimposed by commercial thoughts. PSPM, however, does not primarily aim to secure access to critical input resources. Instead, PSPM focuses on the outward provision of functions to serve societal needs (see below for the aspect of “pattern maintenance” as the fourth activity of organizational

functional effectiveness). For practitioners, these insights suggest that SLCA has more potential than PSPM to contribute to adaptation effectiveness by mitigating social risks that might compromise the economic viability of organizations and entire supply chains (Varsei et al., 2014). Such risks include, for example, the loss of reputation when shortcomings, such as the violation of union rights and/or the use of slave workers, are made public by non-government organizations. An implication for businesses willing to engage in sustainability performance measurement and management might be to start with a defensive risk management orientation using SLCA to secure economic viability. Subsequently, more experienced companies might engage in a more proactive and long-term measurement and management of mutual social and sustainability benefits for business and society.

4.5.3. Integration

In terms of integration, the functional model assumes that an organization is effective if it is able to establish appropriate means for coordinating and managing its efforts to achieve functional goals. The open systems focus of organizational effectiveness theory and the resulting supply chain and life cycle orientation are critical barriers that impede the establishment of SLCA and PSPM as means of managerial decision support. The results of the Delphi study emphasize that SLCA and PSPM currently are not (yet) very relevant instruments for practitioners, mainly due to the complexity of supply chains and life cycles. Croes and Vermeulen (2015) argue that scientists currently aim to broaden and deepen damage-based life cycle assessment approaches that become increasingly complex. Although researchers are thus able to demonstrate spatial, temporal, and inter-relational factors that influence damage to sustainability, it becomes increasingly difficult for practitioners to grasp these issues and apply life cycle assessment approaches (Croes & Vermeulen, 2015). Thus, there is an increasing compartmentalization between the methodological development of performance measurement in the literature and the implementation and application of performance measures by

organizational and managerial decision-makers (McCool & Stankey, 2004). Consequently, an implication for researchers is to support managerial decision-makers with a practical yet scientifically robust system to measure and assess social performance and PSP. A starting point would be to agree on a prioritization of a minimum set of social and PSP indicators.

The costs of collecting data can be another serious problem for integration effectiveness (Erol, Sencer, & Sari, 2011), because collecting such inventory data is often highly labor-intensive (Benoît Norris et al., 2014). Therefore, monitoring of social and positive sustainability data requires a commitment of resources (e.g., time and money) through organizational and managerial decision-makers (McCool & Stankey, 2004). High-level management commitment complemented by investing time and money gives visible internal credibility and legitimacy to the implementation of decision-making instruments, such as SLCA and PSPM (Spence & Rinaldi, 2014). Corporate practice increasingly claims to implement performance measurement approaches that integrate indicators of positive value creation. For example, the SEEBalance approach by BASF addresses benefits for disadvantaged individuals due to product quality or company expenditures for social security support (Schmidt et al., 2004). However, researchers have thus far largely neglected to study such performance measurement initiatives from corporate practice (Beske-Janssen et al., 2015). We think this is an omission because reflections on such practice approaches might yield insights into the indicators deemed most useful by practitioners or on how companies implement and adapt SLCA and PSPM to their specific decision-making requirements. Such knowledge could foster our understanding of how to adequately assess the beneficial functional utility of products (as demanded by Schaubroeck & Rugani, 2017) and how organizational factors such as management commitment determine the (im)balance between positive and negative performance measures.

4.5.4. Pattern maintenance

Regarding pattern maintenance, the functional model assumes that an organization is effective if it is able to reduce the strains and tensions in its environment and by serving societal needs. Thus, pattern maintenance addresses the reduction of negative sustainability performance, as well as the enhancement of PSP in the external environment. Whereas the Delphi results emphasize that SLCA is currently aligned to the achievement of internal business needs, PSPM focuses on the internalization of external damage and the outward provision of functions to serve societal needs. Molnar and Rogers (1976) argue that such a focus on the “outflow” of products and services from organizations to the environment to serve societal needs should be central when evaluating organizational functional effectiveness. One way of achieving a transformation into a sustainable society and economy is to internalize the external environmental and social costs (externalities) emerging from current production and consumption patterns (Croes & Vermeulen, 2015; Figge & Hahn, 2004). However, the measurement of externalities and their internalization have not shown significant progress over the past 20 years (Croes & Vermeulen, 2015; Mathews, 1997). Therefore, the significant costs of damage to the environment and people are hidden as these costs are not captured by the established performance measurement approaches. Croes and Vermeulen (2015) argue that researchers and practitioners can measure hidden external costs as the costs of damage or as (positive) investments in damage prevention, compensation, or restoration. In sum, the external costs represent the cost-distance to sustainability, which, if measured and internalized in product prices, would make producers and consumers make more sustainable choices. Consequently, companies willing to sell products that reduce unsustainable issues and generate benefits for human needs might include external costs (e.g., potential restoration investments) to calculate and justify price premiums required to achieve a sustainability transformation (e.g., as a unique selling proposition).

However, the internalization of negative damage and the outward provision of positive functions should be kept as separate issues in performance measurement, because positive and negative performances are empirically and conceptually distinct aspects of the overarching sustainable organizational performance construct and are not opposite ends of a performance continuum (Mattingly & Berman, 2006; Strike, Gao, & Bansal, 2006; Wood, 2010). This speaks against the development of performance indices that allow offsetting between negative and positive measures, and emphasizes the importance of indicator sets that transparently and systematically capture and distinguish between negative and positive performance. Overall, the development of PSPM offers the chance to contribute to a more complete picture of sustainability by incorporating negative and positive performance measures that balance short-term and long-term triple bottom-line performance.

4.5.5. Synthetization of a roadmap for SLCA and PSPM

The preceding discussion provided a consolidated picture of a previously fragmented field. In particular, the discussion emphasizes lessons learned from previous SLCA research that have led to this fragmentation. To avoid further fragmentation in SLCA- and PSPM-related research, Table 11 synthesizes a roadmap for future research that draws upon the lessons and insights from SLCA research as discussed above to derive research implications for SLCA and PSPM. The roadmap is structured along the previously discussed three dimensions of challenges and two dimensions of benefits derived from the Delphi results to provide guidance for SLCA and PSPM in becoming relevant decision-supporting instruments.

Table 11. Research roadmap for SLCA and PSPM

Major topics for future research	Lessons learnt from past SLCA research	Future research implications for SLCA and PSPM-related research
(1) Definitional challenges	SLCA literature developed indicators (technically) before tackling the complexity of social issues and agreeing on what cross-cultural goals constitute social performance.	SLCA and PSPM research needs to invert that approach and first reach a consensus on what constitutes social performance and PSP, before developing technically measurable indicators.
(2) Methodological challenges	SLCA research is facing a plethora of good social indicators, but lacks agreement on a valid and legitimate indicator selection process. Delphi experts and extant literature disagree on the developmental stage of SLCA that lags behind ecological and economic performance measurement.	SLCA and PSPM researchers need to intensify case study research to gain empirical experience on the establishment and generalization of methodological rules (e.g., for the indicator selection process). SLCA research needs to make up leeway (e.g., prioritization of positive and negative indicators) before engaging in a truly holistic integration with ecological and economic performance measures.
(3) Managerial challenges	Organizational decision-makers are committed to implement short-term oriented SLCA under the condition that it serves short-term economic benefits (e.g., brand image and reputation) of the organization.	Research on SLCA and PSPM initiatives from corporate practice might yield insights on which performance indicators are prioritized by practitioners and which drivers and barriers influence a shift from measuring short-term to long-term performance.
(4) Organizational benefits	SLCA has difficulties in supporting sustainable new product development and innovation efforts, because SLCA is rather used for defensive risk-management purposes instead of proactively collaborating with other value chain partners to generate and communicate knowledge about components, ingredients and working conditions along product life cycles.	From a relational view (Dyer & Singh, 1998), researchers can investigate the drivers and barriers of knowledge-sharing routines among value chain partners that determine SLCA and PSPM to move from organizational risk management to inter-organizational collaboration and innovation.
(5) Societal benefits	Societal benefits result from a sustainability transformation of current consumption and production patterns.	PSPM research can contribute to the sustainability transformation by capturing and ultimately internalizing hidden externalities, by incorporating a balance between measures of efficiency, consistency and sufficiency, and by balancing short-term business performance and long-term ecological and societal impact indicators.

The previous discussion and resulting roadmap for SLCA and PSPM yield several new insights and implications for scholars and managerial practitioners alike. First attempts to suggest indicators for PSPM mainly revolve around people's employment, health benefits, the uptake of pollutants from the environment, and the functional utility of products (e.g.,

Schaubroeck & Rugani, 2017). However, PSPM faces similar definitional and methodological difficulties as the SLCA field, if the search for relevant indicators continues to be preconceived by ideological principles and normative values (McCool & Stankey, 2004). Consequently, without a transparent agreement on the moral and ethical question of what to measure and achieve, SLCA and PSPM will remain controversial. The absence of such a consensual measurement conceptualization hinders further theory development. In this regard, the UN (2015) SDGs could provide a globally consensual and normative foundation to capture positive contributions to sustainable development. However, the goals aim at country-level contributions that first need to be related to the organizational and product level (Kühnen & Hahn, 2017).

Without general standardized measures, researchers use different and nonequivalent measures that they subjectively believe are most related to organizational effectiveness (Webb, 1974) but which yield in contradictory results. The development of general measures of PSP would promote standardization that, in turn, facilitates the comparison of empirical results and thus contributes to the development of organizational functional effectiveness theory (Price, 1972). Currently, however, without such a clear conceptualization and measures of PSP at organizational and product level, managers will keep struggling to recognize a clear relationship between business conduct and positive sustainability benefits for society (and vice versa). For example, Wood (2010) argues that positive social performance only has an inconsistent relationship with financial performance (Wood, 2010) because sustainability data can be highly incomplete, uncertain, and unreliable (Shokravi & Kurnia, 2014). Therefore, without establishing reliable PSP measures, win-win opportunities for business organizations and society will continue to be unmeasured and unnoticed.

Finally, a major difficulty for researchers when investigating the potential win-win relationship between business and society is that corporate performance measurement systems

often remain a black box for others outside the applying company (Lisi, 2016). Yet research on the internal development, implementation, and evolution of PSPM would be particularly useful to understand and validate how firms and managers perceive the usefulness of PSPM to measure and generate sustainability benefits. Such opportunities and benefits for business organizations include, for example, advancing new technologies, setting industry standards, reaching new customers, developing new markets, achieving competitive advantage through product differentiation, and premium pricing capability (Beske & Seuring, 2014; Wood, 2010).

4.6. Conclusion

This Delphi study offers valuable findings for research and managerial practice in the field of SLCA and PSPM. First, we contribute by providing a structured overview of extant literature on measuring and managing positive sustainability benefits. By reviewing key references in the field, we established a picture of trends and gaps in the currently isolated and scattered PSPM research endeavors. Therefore, this paper consolidates a number of issues that have previously been discussed separately in the literature on social and positive performance measurement. By analyzing these challenges and opportunities in light of extant but disconnected research, we contribute by providing a more coherent and deeper understanding of a fragmented field. Specifically, we identified five major topics (dimensions; i.e., definitional, methodological, and managerial challenges as well as organizational and societal opportunities) to structure the overall debate on SLCA and PSPM. Second, we contribute to organizational effectiveness theory by using the functional model as a lens for analyzing our results and elaborate how the challenges and opportunities of SLCA and PSPM impede or contribute to organizational effectiveness. Furthermore, the discussion highlights how previous endeavors in SLCA research have determined the fragmentation of the field. Therefore, we developed a roadmap along the five major dimensions that reveals lessons learned from past SLCA research to derive implications for future research on SLCA and on PSPM. Beyond the scholarly discussion and

implications, we explain the relevance of our insights for practitioners in sustainability performance measurement and management.

The findings of our study form a starting point for further consolidation of research on SLCA and PSPM. Overall, we argue that SLCA has become a defensive risk management instrument to protect firm reputation and brand image, whereas PSPM offers the potential to proactively measure and achieve the positive societal benefits of organizational behavior. Therefore, future researchers should intensify efforts to harmonize the fragmented SLCA approaches and aim to advance and validate PSPM. Furthermore, we contribute by suggesting a new positive perspective in sustainability measurement and management practice. There are still several critical roadblocks on the way to changing the established negative perspective on sustainability as a necessary and costly evil to maintain legitimacy against social and environmental harms and damages. However, analogous the establishment of positive psychology (Seligman & Csikszentmihalyi, 2000), we argue that PSPM has the potential trigger moving from “trying to fix what is wrong” (Luthans, 2002, p. 57) toward realizing sustainable win-win opportunities for organizations and society (Lyneis & Sterman, 2016).

5. Fourth study: “Characteristics of positive sustainability performance: A qualitative empirical framework”²⁰

Abstract. Current sustainability performance measurement approaches primarily capture negative burdens and their reduction throughout product life cycles and supply chains. However, merely assessing and mitigating unsustainable problems lacks ambition, with slim prospects of contributing to sustainable development. Therefore, recent research increasingly calls for a transition from negative to positive sustainability performance (PSP) measurement that reflects benefits of human and industrial systems to nature and human well-being.

²⁰ The fourth study has a working paper status (single authored).

However, research lacks a universal understanding of what constitutes PSP, which is a critical obstacle for its measurement and management. Therefore, this paper aims at establishing the characteristics of PSP. To achieve this aim, this paper uses qualitative interview based reasoning to analyze the practices and routines of actors along all life stages cycle of laundry detergents as a case study. In the light of practice theory, this paper identifies and prioritizes a set of characteristics that constitute PSP. These PSP characteristics especially point to the importance of product attributes (e.g., functional performance), collaborations to promote sustainable development (e.g., cooperative investments in developing countries), and promoting skills and knowledge about sustainable production and consumption (e.g., through sustainable customer education). By synthesizing and discussing a framework of PSP, this paper provides a first step toward a universal understanding of how industrial production and consumption contribute to sustainable development. Furthermore, it establishes a foundation for the future development of indicators assessing sustainable business practices that go beyond merely counteracting negative business outcomes toward actually delivering sustainability benefits for business and society.

5.1. Introduction

It is now 30 years since the World Commission on Environment and Development (WCED) published its famous Brundtland report including its definition of sustainable development (WCED, 1987). Since then, measuring sustainability performance has become an essential topic in industrial ecology as scholars, regulators, and business organizations increasingly look at the integrated Triple Bottom Line (Elkington, 1997) of economic, ecological, and social value creation of products and organizational behavior (e.g., Blass & Corbett, 2017; Maas et al., 2016b). So far, however, research and practice primarily thought about how to become less unsustainable instead of making and assessing positive progress to sustainable development (e.g., Sala et al., 2013a; Schaubroeck & Rugani, 2017). Therefore, management scholars and

practitioners tend to have a negative perspective on sustainability and concentrate on “trying to fix what is wrong” (Luthans, 2002, p. 57).

Consequently, current sustainability performance measurement primarily captures negative burdens or footprints (e.g., accidents and fatalities, carbon dioxide emissions, or total cost of ownership) and their reduction throughout product life cycles and supply chains (Beske-Janssen et al., 2015). Although fixing or reducing negative sustainability problems is a valuable objective, George (2001) argues that merely mitigating unsustainability lacks ambition, with slim prospects of contributing to sustainable development. The focus on negative sustainability issues is a deficiency in current performance measurement approaches (e.g., environmental life cycle assessment; ELCA; Ekener et al., 2016) because academia and business practice thus miss the opportunities of measuring and managing positive sustainability performance (PSP). Such opportunities include, for example, pushing the acceptance of sustainability in business and society (Beske-Janssen et al., 2015), developing sustainable business models and practices that actually deliver societal and environmental benefits instead of merely counteracting negative business outcomes (Bocken, Short, Rana, & Evans, 2014), and recognizing and realizing win-win-opportunities for business and society (Kroeger & Weber, 2015; Lyneis & Sterman, 2016).

Although researchers increasingly call for a transition from negative to positive sustainability performance measurement (PSPM; e.g., Antolín-López et al., 2016; Beske-Janssen et al., 2015; Delmas et al., 2013; Ekener et al., 2016; Gibson, 2013; Pauw et al., 2014; Sala et al., 2013a), only a few researchers have actively engaged in a discussion (e.g., Baumann et al., 2013; Wilhelm et al., 2015). Recently, Schaubroeck and Rugani (2017) criticized the existing approaches of life cycle sustainability assessment (LCSA) as being incomplete because of their prevalent “paradigm that mankind damages the environment [thus neglecting] the other side of the coin” (i.e., indicators systems reflecting benefits of human and industrial systems to nature and human well-being; p. 8).

A critical reason for this shortcoming is that extant research is fragmented and lacks consensus in terms of characterizing PSP. For example, Minor and Morgan (2011) argue that PSP results from avoiding or reducing negative and unsustainable issues or footprints, whereas Di Cesare et al. (2016) contend that sustainability performance is positive when it goes beyond the compliance with regulations or standards. Alternatively, Kroeger and Weber (2015) consider PSP as the degree to which organizations actively benefit society and help stakeholders meet their needs. Therefore, this paper argues that research lacks a universal understanding of what constitutes PSP, which is a critical obstacle for measuring and ultimately managing PSP. Such a universal understanding of characteristics of the PSP construct would contribute to establish a foundation for the development of generalized measures and indicators that clearly reflect PSP. However, existing sustainability assessment concepts and frameworks fail to provide such as universal understanding because they are too often based on common sense instead of empirical experience, and thus, do not adequately guide the selection of consensual sustainability indicators (Baumann et al., 2013). Consequently, the assessment of sustainability performance currently varies depending on various internal and external factors (e.g., firms' sustainability orientation, or stakeholder pressure; e.g., Boukherroub et al., 2015; Gualandris et al., 2015).

Because of the lack of an empirically based universal understanding of a conceptual construct, researchers use different and nonequivalent measures that they subjectively believe are most related to the construct (Webb, 1974). Therefore, scholars find contradictory results and cannot arrive at abstract, theoretical formulations of conceptual constructs (Price, 1972) such as of PSP. Consequently, understanding the characteristics of PSP will (1) contribute to the standardization of general measures and indicators, (2) facilitate the comparison of empirical results, and thus (3) contribute to the development of a theoretical and normative foundation for PSPM. Therefore, the aim of this paper is to answer the following research

question: What are the characteristics of positive sustainability performance along product life cycles and corporate supply chains?

To achieve this aim, this paper uses practice theory to analyze the practices and routines of actors along the life cycle of laundry detergents as a case study. Gram-Hanssen (2010) emphasizes the value of practice theory in industrial ecology research because it explains that practices and routines are key to constituting and understanding phenomena (such as PSP). The case of laundry detergents is especially valuable to analyze and understand positive sustainability benefits because previous research has shown the potential of laundry detergents to improve everyday life (e.g., by contributing to health and hygiene; Seuring et al., 2003). Furthermore, Seuring et al. (2003) argue that the laundry detergents industry is often taking a proactive role in terms of developing new assessment approaches, and is thus even setting examples for other branches from the chemical manufacturing and consumer goods industry. Furthermore, by investigating the practices and routines of actors along all stages of the product life cycle, this paper answers the frequent calls for a more comprehensive scope of sustainability assessment in industrial ecology research which is often neglecting certain stages (especially the product use phase; e.g., Blass & Corbett, 2017; Fransson, Brunklaus, & Molander, 2013; Seuring, 2008).

This paper is structured as follows: Following the introduction, the second section introduces practice theory as a valuable analytical lens by elaborating its relationship with industrial ecology and sustainable development. The third section explains the method of collecting and qualitatively analyzing the case study data. Next, the fourth section presents and analyzes the results in terms how actors along the life cycle of laundry detergents perform practices that characterize and constitute PSP. Building on the results, the fifth section discusses an empirically based analytical framework of characteristics of PSP. Thus, this paper establishes

a foundation for the promising field of PSPM. Finally, this paper concludes by highlighting the main contributions to research and practice.

5.2. Theoretical background: The relationship between practice theory and sustainable development

Gram-Hanssen (2010) highlights the value of practice theory for industrial ecology research because practice theory helps understanding how human actors perform practices that determine the constructs of industrial production and consumption (e.g., of laundry detergents). Practice theory is a cultural theory that offers an analytical lens to investigate human behavior (Reckwitz, 2002; Schatzki, 1997; Schatzki, Knorr Cetina, & Von Savigny, 2001; Shove & Pantzar, 2005; Warde, 2005). Reckwitz (2002) characterizes a practice as “a routinized type of behavior which consists of several elements, interconnected to one other: Forms of bodily activities, forms of mental activities, things and their use, a background knowledge in the form of understanding, know-how, states of emotion and motivational knowledge. [...] A practice is thus a routinized way in which bodies are moved, objects are handled, subjects are treated, things are described, and the world is understood” (p.249–250). Table 12 provides an overview and description of these elements that collectively constitute practices.

Table 12. Overview of elements that collectively constitute practices

Practice elements	Description of practice elements and connection with performance
Meaning	The element of meaning describes understandings and ideas of what the performance of practice is good for, or why it is problematic. Meaning involves emotions, affections, beliefs, desires, or general aims (e.g., sustainable development; Gram-Hanssen, 2010) that determine how human agents perceive their role when performing practices in terms of why and how practices make sense to human agents (Røpke, 2009).
Body	Human agents perform practices by regular and skillful bodily activities and movements (Reckwitz, 2002). The body is not only a disconnected element, but it is also related to the other elements. For example, it is the bodily location of meanings or an instrument for using things and objects required for certain practices. Furthermore, performing a practice contributes to shaping or impacting the body (Røpke, 2009).
Things	Performing a practice often requires using particular things in a certain way (Reckwitz, 2002). Therefore, practices are determined by material objects, products, hardware, equipment, machinery, or technology (Gram-Hanssen, 2010) involved in performing the practice (Shove & Pantzar, 2005).
Competence	Competence involves the skills and knowledge needed to perform practices. Competence, skills, and knowledge are learned by experience and training (Shove & Pantzar, 2005) and become embodied in human agents' performance (Røpke, 2009). The element of competence is more complex than the mere knowledge about routines, procedures, and formal rules or instructions. Instead, it encompasses an understanding of the interconnectedness of the other practice elements that need to be integrated into performances. For, example competence in playing football requires an understanding of oneself (e.g., position and purpose on the field), things required (the ball), and other human agents involved (team members; Reckwitz, 2002).
Interplay	Performing practices often requires interaction, coordination, cooperation, and discourse with other human agents (Reckwitz, 2002). Multiple human agents may perform symmetrical practices (e.g., football players interact to score). Sometimes, human agents perform mutually conditioned asymmetrical practices (e.g., the practice of education involves teachers who give lectures and students who listen to the lecture; Røpke, 2009).
Space	Practices take place in certain locations. Performing practices is thus constrained by the impossibility of participating in simultaneous but spatially separated activities (Røpke, 2009).
Time	Practices take up time and performing practices is constrained by finite temporal resources. The time element includes aspects such as the duration of periods and the sequence of points in time when performing practices (Røpke, 2009).

By combining these interdependent elements, actors (practitioners) are able to perform a practice (e.g., as a way of laundering, producing, or consuming; Røpke, 2009). Therefore, the practice elements precede and determine an actors' performance (Warde, 2005). Practices can also be transferred from the individual level to the organizational, and supply chain level (Swidler, 2001). In this regard, a business organization (or supply chain) is a larger and more complex set of actors who combine the practice elements to perform a nexus of practices (Nørreklit, Nørreklit, & Mitchell, 2016).

Nørreklit et al. (2016) argue that a goal orientation towards the subjectively good and valuable drives human actors to perform practices. The conception of the good holds the practice elements together by giving human actors a subjectively meaningful goal to pursue

(Gram-Hanssen, 2010). Thévenot (2001) suggests that the performances of practices are “avatars” (p. 67) or representations of the good and valuable. Several researchers argue that sustainable development can be normatively considered as good and valuable in management thinking and business practice (e.g., Hahn, 2011; Isaksson et al., 2010; Nørreklit et al., 2016; Steurer, 2006). Therefore, sustainable development represents a subjectively valuable goal for human actors who perform practices to fulfill their needs and sustain their well-being (Schaubroeck & Rugani, 2017). Consequently, practice theory provides a useful lens of structuring and analyzing the practice elements that constitute performances aiming at sustainable development (i.e. PSP) along the product life cycle stages laundry detergents.

5.3. Method

This research is based on a case study (Yin, 2013) of the life cycle of laundry detergents. To collect data in case studies, interviews are commonly employed to provide scientific explanations based on an understanding of peoples’ lived world and experiences (Kvale, 2007). The evidence in this paper was collected by using semi-structured face-to-face interviews. The main aim of the interviews was to obtain an in-depth understanding of the accounts given of the daily practices and routines performed by actors along the entire life cycle of laundry detergents (i.e., including the system boundaries from raw material sourcing to the use and end-of-life stages). The case study is based on interviews with managers, workers, users, and other actors along the product life cycle of laundry detergents (conducted in 2014, in Germany). Thus, this paper aims at answering the call for studies “involving actors from several stages of a product chain” (Fransson et al., 2013, p. 311; see also Seuring, 2008) in industrial ecology research. The actors’ perspectives obtained were used to develop an understanding of how the production and consumption of laundry detergents have a positive sustainability impact in peoples’ subjective perception and experience. To ensure replicability, this research adhered to the structured approach, as described in the following.

5.3.1. Data collection

Interview partners (IPs) were selected using purposeful sampling (Palinkas et al., 2015; Patton, 2015) to conduct detailed interviews with actors in a specific industry. Table 13 provides an overview of the selected IPs as key informants for in-depth information. The IPs represented actors along all product life cycle stages of laundry detergents. Managers, workers, and consumers from seven organizations agreed to partake in the interviews. The primary reason for selecting the actors along the product life cycle was that all actors had professional expertise in terms of the individual daily practices and routines performed in each life cycle stage comprising the production and consumption of the case product. Furthermore, because each actor was professionally engaged with aspects of the industry (including consumers which were organized in a professional association of housekeepers), the selected IPs could be expected to have a broad perspective on the production and consumption of the case product. Thus, key informants were selected as sources of in-depth information on the life-world practices and performances that shape sustainability during the production and consumption of laundry detergents.

Table 13. Overview of interview partners (IPs)

Product life cycle stage	IPs	Job position	Organization
1 st tier supplier	IP:1	Global sustainability manager	Supplier of chemical materials
	IP:2	Regional key account manager	
		Head of customer service	
	IP:3-5	Customer service employee	
		Customer service employee	
Manufacturing	IP:6	Plant director	Laundry detergent manufacturer
	IP:7	Deputy operations manager of powder detergent production and head of engineering	
	IP:8	Team leader of liquid detergent production	
	IP:9	Operator of liquid detergent filling	
	IP:10	Director of research and development for process technology	
	IP:11-12	Chief medical officer of occupational medicine Senior manager of corporate health	
Transportation and logistics	IP:13	Director of international planning and logistics steering	Laundry detergent manufacturer
	IP:14	Manager of international planning and logistics steering	
Wholesale and retail	IP:15	Project manager sustainability	Wholesaler
	IP:16	Branch manager	Drugstore company
	IP:17	Branch manager	
	IP:18	Branch manager	
Use	IP:19	General executive director	Professional association of housekeepers
	IP:20	President of local association	
	IP:21	President of local association	
Disposal	IP:22	Eco-toxicologist	Regional consumer advice center
	IP:23	Director of waste and water management	Laundry detergent manufacturer
	IP:24	Waste management specialist engineer	
	IP:25	Waste management engineer	
	IP:26	Environmental compliance director	
	IP:27	Director of chemical and biological laboratories	Urban sewage and wastewater treatment facility

Note that the interview partners 3-5, and 11-12 needed to be interviewed collectively in a group session.

The interviews were conducted between March and December 2014. Data collection involved 24 one-time interview sessions with 27 German speaking IPs (conducted in German). Commonly, the sample size when conducting qualitative in-depth interviews ranges from 15 to 40 participants (De Ruyter & Scholl, 1998). Guest, Bunce, and Johnson (2016) argue that conducting more than twelve interviews takes research beyond the point of theoretical saturation (i.e., the point when phenomena start repeating and no new information are observed in the interview data; Hahn & Ince, 2016). The interviews were administered through a set of

open-ended questions to encourage the interview partners (IPs) to engage in an open and unrestrained face-to-face dialog with the interviewer (Horton, Macve, & Struyven, 2004).

The open qualitative questions started with, first, asking the IPs how their daily routines and activities look like when they perform practices along the life cycle (i.e., routines within the system boundaries of supplying commodities and services, manufacturing, transporting, distributing, selling, using, and disposing laundry detergents). The rationale behind this question was to provide a narrative stimulus to trigger a dialog between the interviewer and the IPs about their daily performance of practices. Second, to complement this first narrative stimulus, the IPs were asked to specify how they see their role (meaning element), how their typical bodily activities look like (body element), what equipment and machinery (things element) as well as skills and knowledge (competence element) are especially important, how their interaction and cooperation with other persons typically look like (interplay element), how the locations where the IPs perform practices look like (space element), and how the IPs perceive the points or periods in time when they perform practices (time element). The rationale behind these complementary questions was to ensure that the IPs included all practice elements in their elaborations, if they did not address them after the first narrative stimulus. Third, the IPs were asked to elaborate what they perceive as especially positive aspects when they perform practices in general, and when they think about the individual practice elements in particular. Furthermore, the IPs were asked how they would improve these aspects. The interviews lasted between 50 minutes (minimum) and three hours (maximum). On average, an interview lasted 75 minutes. All interviews were digitally recorded and subsequently transcribed. Overall, the interview data collected comprised roughly 308.000 words (nearly 34 hours) of interview material.

5.3.2. Data analysis

The next step was to analyze the material with an abductive content analysis approach (Duriau et al., 2007; Mayring, 2010). Abduction is based on a reiterative combination of a researcher's sophisticated understanding of a theoretical framework with phenomena emerging from the empirical material under investigation (Alvesson & Kärreman, 2007; Van Maanen et al., 2007). In other words, an abductive analysis aims at combining established theoretical conceptualizations with perceived phenomena that emerge from the data (Timmermans & Tavory, 2012). Employing the abductive logic in this research, this paper chose the practice theory elements (see again Table 12) as theoretically based coding scheme to observe the data. Therefore, the transcribed interview material was assigned to the practice elements to observe the relative prevalence of the practice elements when the IPs talk about their daily routines aimed at positive contributions to sustainable development. Subsequently, this paper derived characteristic dimensions of PSP from the empirical material under investigation (i.e., the characteristics of PSP emerged from the interview material). Then, these PSP characteristics were recursively related to the practice theory elements to analyze how the relative prevalence of the practice elements determines the practitioners' daily routines that aim at positive contributions toward sustainable development.

In terms of validity, researchers argue that verbal expressions about practices are a key unit of analysis for examining value creation and PSP in production and consumption, because words are vehicles for developing and facilitating conceptual understanding of practices and performances (e.g., Holttinen, 2010; Nørreklit et al., 2016). Although people cannot transfer all their tacit knowledge about practices to lingual expressions (Holttinen, 2010), they can nevertheless reflect on their daily routines and talk about their practices (Hitchings, 2012). To ensure reliability of the analysis, the data were analyzed in an iterative process of manual coding and re-coding. First, three initial transcripts were independently coded (using the deductive

coding scheme of practice elements) by two individuals who are experts in the field of sustainability management and skilled in interview-based research. Then, the resulting codes were discussed between the two researchers to align mental schemes (Seuring & Gold, 2012). Subsequently, based on the aligned interpretations of the initial codes, the author of this paper continued solely coding and analyzing the remaining 21 transcripts. Regarding generalizability, case studies are typically difficult to generalize (Yin, 2013). However, choosing the life cycle of laundry detergents as a case study contributes to the generalization of findings because laundry detergents are widespread, common, and everyday products (Seuring et al., 2003).

5.4. Results

The following results section provides an analysis in terms of the prevalence of practice elements addressed by the IPs when talking about positive aspects and improvements of their routines and activities throughout the life cycle of laundry detergents. Particularly, this section analyzes what are the most prevalent practice elements addressed by the IPs. Furthermore, it explains how the characteristics of each stage of the laundry detergent life cycle determine the differing prevalence of practice elements between the life cycle stages. Building on these elaborations and illustrative quotations, this section will derive characteristics of PSP that determine how practitioners contribute to sustainable development by performing their practices (i.e., their daily routines) along the life cycle.

5.4.1. First tier supplier

In terms of sourcing raw materials from the first tier supplier, the IPs primarily address the practice elements of things, interplay, and time. Table 14 provides illustrative quotations to show the most prevalent practice elements and to derive relevant PSP characteristics when sourcing product materials. Suppliers from the detergent life cycle can contribute to sustainability by providing innovative product ingredients based on renewable raw materials.

Regarding the production volume, surfactants (i.e., surface-active agents that reduce the surface tension in a liquid) are used “in basically every detergent formula [...]. It is the so-called ‘working horse.’ It is the ingredient with the largest share per formula [of washing active substances that support an effective cleaning performance]” (IP:02). The most significant renewable raw materials for producing surfactants are coconut oil and palm (kernel) oil (Patel, 2003).

Although contributing to regional economic development, palm oil plantations in Indonesia, Malaysia and other countries have become a subject of public debate about “the environmental and social dilemma” (IP:01) in terms of detrimental impacts on sensitive landscapes such as tropical deforestation, draining of peat wetlands, the destruction of habitats for endangered species, or displacement of indigenous people (Dale et al., 2013). Nevertheless, palm (kernel) oil is a highly productive and efficient crop that requires less land to grow compared to other vegetable oils (Silalertruksa & Gheewala, 2012). Furthermore, it can have positive socio-economic effects by creating rural employment among smallholder farmers. Correspondingly, IP:01 emphasizes the positive opportunities for sustainable development, if suppliers and manufacturers intensify their efforts to cooperatively engage in sustainable smallholder development projects that create employment while protecting sensitive eco-systems. In this regard, IP:02 points to the importance of cooperating with partners to set standards and refers to the establishment of the Roundtable on Sustainable Palm Oil (RSPO, 2013) that developed a certification system with principles and criteria for improving sustainable palm oil production (while being “aware that it is not ideal, yet;” IP:01).

Table 14. First tier supplier: Overview of most prevalent practice elements and derivation of PSP characteristics

Practice elements	Illustrative quotations	PSP characteristics
Things	<p>“It is positive that we sell ingredients to the customer [manufacturer] that are not environmentally harmful, but renewable.” (IP:03)</p> <p>“We rely on the principles and criteria of the Roundtable on Sustainable Palm Oil including a set of social criteria. By sourcing from these RSPO members, [the RSPO certification system] is our platform to consider social criteria. Nevertheless, we are aware that it is not ideal, yet. But it already is a very good approach.” (IP:01)</p>	<p>Contribution toward a circular economy</p> <p>Quality of product ingredients</p>
Interplay	<p>“For society, it would be positive, if we would succeed in recognizing more win-win opportunities between both firms [i.e., the 1st tier supplier and the manufacturer] and work together to identify more issues where this cooperative approach can have effects. For example, we are currently discussing the case of palm oil focusing on the environmental and social dilemma when cultivating in Indonesia. This raw material is processed into surfactants, which we deliver to [the manufacturer]. We could imagine a joint smallholder project with a social relevance. Then, we could jointly care about the cultivation and harvesting of the palm kernel oil that we use. [...] That is a contribution on the social side.” (IP:01)</p>	<p>Cooperation on engagements in developing countries</p>
Time	<p>“In terms of palm kernel oil, there is the RSPO standard [...] the Roundtable on Sustainable Palm Oil. That is a joint consortium including purchasers, planters, and companies like us [...], one of the first chemical companies] that became a member in the RSPO.” (IP:02)</p> <p>“We have had good experiences when tailoring our IT systems with the early establishment of a joint team [between the supplier and manufacturer] that aimed at avoiding delays in supply. We perceived it as very positive, that you establish a team that supports this bridging period if it is predictable that things will be adapted. Both firms did not want to risk that tailoring the IT systems would result in delayed supply and loss of production.” (IP:01)</p>	<p>Standard setting and membership</p> <p>Reliability of distribution</p>

5.4.2. Manufacturing

At the manufacturing stage of the laundry detergent life cycle, things are again the most prevalent practice element, followed by the elements of competence and body. Table 15 illustrates relevant quotations about the most prevalent practice elements in manufacturing and derives corresponding PSP characteristics. Laitala, Boks, and Klepp (2011) notes that the production and formulation of laundry detergents changed significantly to develop and introduce new product forms (e.g., highly or even super compacted powders and concentrated liquid detergents) that, for example, “aim at reducing the washing temperature required because, especially in the use phase of laundry detergents, a lot of energy is consumed” (IP:10). Furthermore, through compaction and concertation, the share of washing-active substances (particularly surfactants) has increased resulting in a lower dosage required while keeping a constant (functional) washing performance. As IP:10 notes, “that is only possible through continuous improvements of ingredients such as surfactants and enzymes [...] to continuously reduce the dosage of laundry detergents per wash-load. Today we are at 65 grams [of laundry detergent required] per wash-load. 15 years ago, we were at 150 [grams]” (IP:10).

To manage and improve product quality and cost efficiency, detergent companies have built continuous and increasingly automatized production processes (Levinson, 2009). The trend towards highly automatized production processes requires training for operators to work efficiently and flexibly. To take full advantage of theoretical training, IP:06 also stresses the importance of practical working experience on the job. At work, “in areas where enzymes are processed, occupational health and safety measures” (IP:06) are of particular importance to protect workers against fine enzyme particles from dust in the powder production or aerosols in liquid production. Despite “vacuuming enzyme-containing dusts [...], annual blood tests for allergies are conducted” (IP:10). IP:11 emphasizes that, despite protective equipment and preventive measures such as enzyme encapsulation, periodic occupational health assessments

are necessary to avoid sensitization and symptoms such as occupational asthma because enzymes can be allergenic at very low concentrations in air (Nicholson, Newman Taylor, Oliver, & Cathcart, 2001).

Table 15. Manufacturing: Overview of most prevalent practice elements derivation of PSP characteristics

Practice elements	Illustrative quotations	PSP characteristics
Things	<p>“Powder-based detergents [...] are qualitatively better than liquid detergents [...], because, in the powder, optical brighteners [e.g., bleach] can be integrated more stable. [...] If there are tough stains, like wine in a tablecloth, you should use a powder detergent because it is more stable in terms of containing optical brighteners resulting in a better washing performance.” (IP:07)</p> <p>“In our Intranet, you have the option to enroll for online training courses, independently from your supervisor. It covers a broad range of topics including management, technical topics, and health aspects. Furthermore, we have a training and education department that compiles a catalog, e.g., of technical topics, for which an employee needs to register so that he can participate for one to five days in the training program. We also offer external trainings [...] Recently, I sent a group to a hazardous goods training for handling hazardous goods and resending empty containers. Last year, we invested in a robot. I sent an electrician to the manufacturer for a robot training in terms of programming and troubleshooting. Ultimately, it is very much based on one’s own initiative. [...] Unless, it is about safety relevant topics. For example, a third of my employees is required to have visited a first aid training [...] or a certain number of fire drills.” (IP:07)</p> <p>“Often, you cannot really benefit from training courses and seminars. But, what is really helpful is learning on-the-job.” (IP:06)</p> <p>“We developed a line-technician model. In the past, we organized the metalworkers, mechanics, and electricians in workshops. Then, we thought that there is no sense in having so many operators at the production line, who need to call the workshops if there is a problem. Because then, the operator needed to take a break while the mechanics and electricians were conducting repairs. Therefore, we started the line-technician program. That means that we integrated the mechanics and electricians into the production [...] to operate the lines and machines while also being able to repair them if necessary.” (IP:07)</p>	Functional performance of products
Competence	<p>“For every work activity, there is a so-called work activity analysis. This means that every step is analyzed to detect potential hazards, determine preventive measures, and provide protective equipment.” (IP:06)</p> <p>“The company medical officer conducts enzyme-examinations on a regular basis. The problem with enzymes is that they can potentially sensitize, i.e., cause allergies. Therefore enzyme sensitivity needs to be checked regularly.” (IP:08)</p> <p>“For the laundry detergent production, we conduct audits [...] including interviews with the workers; e.g., asking them if they have a sufficiently protective equipment, or if there are new hazards.” (IP:11-12)</p>	Sustainability measurement and management
Body	<p>“Speaking of protective equipment, none of the workers is working without protective equipment which has various qualities. In the workshop, it is non-flammable. At the production line, it is repelling chemicals. [...] In certain areas, we require our workers to wear safety helmets, glasses, and shoes. [...] There are diverse protective equipment items.” (IP:07)</p> <p>“[...] if there is any health risk at all, it would be the dusts. Therefore, it is important that there is very good vacuum cleaning. [...] because of the relatively high amount of enzymes we use by now, we need to take safety prevention measures in terms of vacuuming enzyme-containing dusts. [...] our people need to know, that [enzymes] can have a sensitizing effect, especially proteases.” (IP:10)</p>	Health and safety

5.4.3. Transportation and logistics

Regarding transportation and logistics, the practice elements of interplay and body are the most prevalent. At this stage of the life cycle, the IPs also address the practice element of space. Table 16 includes illustrative quotations about each practice element and derives PSP characteristics. Logistics and transportation play a pivotal role for raw material sourcing, assembling, warehousing, and delivering finished products to market. Today, globalization has driven logistics structures of laundry detergents to become internationally connected. As IP:13 notes, “we produce within the market, near our customers [...]. In the so-called ‘wall-to-wall concept’, we have a direct connection between [our] production and the [customers’] warehouse. [...] In our concepts, we ignore national borders, if possible.” Since global supply chain and logistics management recognizes all the material, service, information and capital flows associated with the cooperation among companies in cross border supply chains (Seuring & Müller, 2008a), logistics managers are in a unique interface position. In this regard, IP:13 stresses the influence of logistics managers to promote positive contributions to sustainability by establishing long-term relationships with shipping partners that comply “with our requirements and values in terms of social aspects.”

Since the transport sector is characterized by high competition, price sensitivity, and small margins, companies often tend to base their business behavior and sustainability-related decision-making on economic factors. Additionally, there is a widespread understanding of sustainability as environmental protection within the transport industry, so that social issues such as transport safety or physically draining occupations are rarely made explicit (Kudla & Klaas-Wissing, 2012). As an example of improving health and safety when transporting laundry detergents, IP:13 points to increasing efforts of compacting detergents. The resulting weight reductions at constant washing performance help easing physically draining activities,

e.g., when commissioning detergents, putting detergents in transportation vehicles or on store shelves (retail logistics), and when consumers take their laundry detergents home.

Table 16. Transportation and Logistics: Overview of most prevalent practice elements and derivation of PSP characteristics

Practice elements	Illustrative quotations	PSP characteristics
Interplay	<p>“[...] we pay close attention in terms of how our logistics service partners deal with [their employees]. Partially, the logistics sector does not have the best reputation. Especially in some countries, the logistics sector has the bad reputation of cheap labor. [...] of course, we are interested in an economic approach. However, we are always interested in a long-term relationship with our service providers. And such a long term-term relationship involves that the service provider complies with our requirements and values in terms of social aspects.” (IP:13)</p>	<p>Promotion of social responsibility along the life cycle</p>
Body	<p>“We try to facilitate and ease the physical activities of commissioning, the packing of a mixed pallet, primarily is a bodily activity. [...] over time, the working conditions improved because the average weight of our transport units decreased [...] due to] our efforts of compacting our products. This means that the amount of laundry detergent required per wash-load can be reduced, so that the packaging size and weight can be reduced as well while keeping the number of possible wash-loads per packaging unit constant.” (IP:13)</p>	<p>Health and safety</p>
Space	<p>“In our modern [warehouse ...], we significantly improved the quality of the working environment in terms of daylight, noise, temperature, ventilation, and other important aspects. When constructing new buildings it is very important that we consider and certify such sustainability aspects. The warehouse is certified with the silver standard.” (IP:13)</p>	<p>Certification of buildings according to sustainability standards</p>

5.4.4. Wholesale and retail

Similar to the previous stages, wholesaling and retailing are characterized by a high prevalence of the practice elements of things, interplay, and competence. Table 17 provides quotations that illustrate the prevalence of the practice elements and derived related PSP characteristics. Hampl and Look (2013) argue that retailers are increasingly interested in the sustainability benefits of their product lines because sustainability benefits are progressively becoming an important factor when it comes to consumers' store choice, buying frequency and willingness-to-pay. Furthermore, retailers play a pivotal role in delivering positive sustainability benefits because they can advise and educate consumers to make affordable and sustainable choices. As IP:15 notes "many consumers have problems with laundry detergents at low temperatures because they never learnt that they work [...]. And here, [retailers] can transfer this knowledge and convince consumers." Paloviita and Järvi (2008) argue that advising consumers in terms of how using specific laundry detergents contributes to sustainability makes consumers perceive themselves as important decision makers in the value chain. Furthermore, advising consumers on sustainable consumption helps consumers to understand their own collective responsibility (Paloviita & Järvi, 2008). To achieve that, consumers need assistance and explanation regarding how to sustainably use laundry detergents. For example, IP:17 notes that "the customer still does not know how to properly dose laundry detergents" (IP:17). In this regard, retail employees play a key role since they come in direct contact with consumers who need advice. Therefore, IP:15 emphasizes the closeness of retailers to consumers and argues that retailers represent an effective channel for manufacturers to receive consumer feedback.

Table 17. Wholesale and retail stage: Overview of most prevalent practice elements and derivation of PSP characteristics

Practice elements	Illustrative quotations	PSP characteristics
Things	<p>“Without the possibilities of distribution, there would be many piles of dirty laundry. Therefore, I like that we have access [to the product]. That is no matter of course. In other countries, you can only get a small shovel of washing powder or a single capsule. So, that is privilege.” (IP:15)</p> <p>“It is positive for us, that the product is on our shelves, so the customers can buy it, and generate revenue.” (IP:18)</p> <p>“[...] recently, [the manufacturer] has reduced the number of wash-loads [per packaging unit] two times. I mean from 18 to 16 and then from 16 to 15 wash -loads. The customers notice that. The price is the same, but it contains less detergent. Then, the customers complain.” (IP:16)</p>	Product affordability and availability
Interplay	<p>“The manufacturer can only tell the customers to read the packaging instructions, refer to the website for further information, or to call the manufacturer. However, the manufacturer will never be directly present in the store. [...] Therefore, a two-way exchange [between the manufacturer and retailer] would be good in terms of [...] what feedback do we get from our customers. That could be very important for the manufacturer.” (IP:15)</p>	Reception and utilization of feedback
Competence	<p>“What we see is that the customer desires transparency. [...] We see that in terms of traceability. The customers want to know that they could retrace where the product is coming from. [...] That relates to trust. [...] In terms of laundry detergents, it is important for the customer to know, where it is coming from, and what it can do, or cannot do.” (IP:15)</p> <p>“[...] in our druggist apprenticeship program,] we educate our apprentices in terms of a broad product knowledge including surfactants and other washing substances. [...] Then, they are supposed to convey their expert knowledge [...] to the customer.” (IP:16)</p> <p>“The customer still does not know how to properly dose laundry detergents.” (IP:17)</p> <p>“Many customers do not know that water hardness plays a role [in terms of dosage].” (IP:18)</p> <p>“The washing performance improved [...] at low temperatures. Today, the washing performance at 20 degree [Celsius] corresponds to the washing performance at 60 degrees in the past” (IP:17), but “the customers do not believe that.” (IP:16)</p>	Transparency and information Sustainable customer education

5.4.5. Using laundry detergents

Although positive sustainability benefits are most likely to occur when using products, the use stage generally is a understudied subject in LCSA research (Ekener et al., 2016). In terms of the use stage of laundry detergents, the IPs primarily address the practice elements of things, competence, and body. Table 18 provides illustrative quotations to show the most prevalent practice elements and to derive relevant PSP characteristics when using laundry detergents. Until the 1950s, washing textiles belonged to the most laborious tasks in the household (Laitala et al., 2011). Soaking, boiling on a stove, washing per hand, rinsing, and wringing were common hard work. Today, the development of new washing technologies and garments have reduced the workload significantly. As IP:19 notes, “in the past, [laundrying] was associated with significantly more effort. [...] You had to soak, for example. Today, it all is extremely comfortable.”

In Germany, the laundry detergent market is largely saturated and highly competitive so that considerable investments are made for marketing purposes (Wagner, 2010). However, IP:19 criticizes that advertising hardly provides any guidance on the proper and sustainable use of laundry detergents and argues that “as a consumer [...], you have few options to inform yourself. You have advertisement. Most people do not believe it anyway. Advertisement only promotes that ‘our [laundry detergent] is the best’ and that you can get everything clean in no time. However, in advertisements you actually do not get any guidance how to handle [laundry detergents]” (IP:19). This indicates that it is hard for consumers to recognize and realize the potential sustainability benefits of laundry detergents. Therefore, IP:19 emphasizes that establishing new forms of consumer education (e.g., via home economics courses in school) might trigger a change of consumer habits towards more sustainable laundering practices (e.g., in terms of dosage and temperature reduction).

Since laundry detergents are everyday products, used regularly in large quantities, users tend to ignore the safety instructions printed on product packaging. In order to eliminate any foreseeable health hazard through skin contact, ingestion, or inhalation, toxicological studies evaluating the health effects of laundry detergent formulations are needed, irrespective of whether ingredients are contained in high or low concentrations. For example, the concentration of fragrances in detergents usually is below one percent. However, IP:21, a user with pre-existing illnesses and allergies, argues that “[...] people with already existing allergies or skin irritations should be careful. [...] There was a time when I could not tolerate general powder detergents. When breathing them in, I got asthma [...]. Then, I needed detergents without fragrance substances, but they were very hard to find.” Certain ingredients such as fragrances can make laundering problematic or even impossible due to allergic reactions. Consequently, tailoring products to the special needs of certain consumers (e.g., persons with disadvantages) is crucial for positive product sustainability improvements.

Table 18. Use stage: Overview of most prevalent practice elements and derivation of PSP characteristics

Practice elements	Illustrative quotations	PSP characteristics
Things	<p>“I have certain laundry detergents that I need. A general powder detergent, a color detergent, a mild detergent, and a wool detergent.” (IP:19)</p> <p>“In the past, [laundrying] was associated with significantly more effort. [...] You had to soak, for example. Today, it all is extremely comfortable.” (IP:19)</p> <p>“In terms of laundry detergents, for me it is important that my clothes become clean and that I wash with a good value for money. [...] This also involves a certain scent.” (IP:20)</p> <p>“It is astonishing, that you can get [so many clothes] clean at low temperatures.” (IP:20)</p> <p>“As a consumer who is not involved with this industry, you have few options to inform yourself. You have advertisement. Most people do not believe it anyway. Advertisement only promotes, that our [detergent] is the best and that you can get everything cleaned in no time. However, in advertisements you actually do not get any guidance how to handle [laundry detergents]. We think that this is a pity and we plead for home economics courses at schools [to teach] everyday-competence. [...] To explain what is included in a laundry detergent and how it works.” (IP:19)</p>	Functional products
Competence	<p>“I would prefer, if there were only concentrated laundry detergents. It would be easier to educate the consumer how to properly dose. Because you have varying packaging sizes, the dosage varies as well. [Therefore,] the consumers always need to read [the varying dosage instructions], but they do not. They dose a concentrated detergent like jumbo, and a jumbo like a concentrate. Always too high or too low.” (IP:20)</p>	Sustainable customer education
Body	<p>“As consumers, we are being informed that clothing needs to have a certain scent of spring. However, [clothing] that is clean should not smell at all. But that is just how marketing is.” (IP:22)</p> <p>“[...] people with an already existing allergies or skin irritations should be careful. [...] There was a time when I could not tolerate general powder detergents. When breathing them in, I got asthma [...]. Then, I needed detergents without fragrance substances, but they were very hard to find. Therefore, I went to certain vendors of biologically and organic products that offered a modular product system. Basically, you had a [mixture] consisting of surfactants, water, [...] bleaching substances for white clothing, and fragrance substances, if you can tolerate them.” (IP:21)</p>	Offering functional products for people with special needs

5.4.6. Disposal

In terms of disposing laundry detergents, the IPs primarily address the practice elements of things, interplay, and meaning. Table 19 provides illustrative quotations to show the most prevalent practice elements and to derive relevant PSP characteristics when disposing detergents. The washing process is as a complex interaction between soiled textiles, water, mechanical and thermal energy, and laundry detergents resulting in clean clothes and wastewater. The concentration of laundry detergents in the wastewater varies due to factors such as washing technology, detergent composition, or dosage for varying soil levels on clothes. Previous studies have shown that laundry detergent residues represent a significant part of domestic wastewater contamination with potential impacts of freshwater eco-toxicity (e.g., Van Hoof, Schowanek, Franceschini, & Muñoz, 2011).

In Germany, when laundry wastewater is disposed via the public sewage system, the concentration of laundry wastewater is being diluted to a level that allows biological treatment in a municipal wastewater treatment plant (Wagner, 2010). The environmental impact and “biological degradability of laundry detergents has been improved significantly in last 35 years” (IP:27) by replacing harmful ingredients with more environmentally friendly constituents. As IP:27 exemplifies, replacing animal fat with vegetable fat to produce laundry detergents (and surfactants in particular) positively contributed to the biological degradability of the laundry detergents by feeding “our biology [and bacteria in the waste water treatment plant].” This example is directly related to the concept of industrial symbiosis arguing that “one company’s waste can become another company’s feedstock” (Chertow & Ehrenfeld, 2012, p. 13).

Table 19. Disposal stage: Overview of most prevalent practice elements and derivation of PSP characteristics

Practice elements	Illustrative quotations	PSP characteristics
Things	<p>“The share of recyclable and non-hazardous waste is very high in laundry detergent manufacturing. We are talking about packaging materials, paper, cardboard, foils and PET [polyethylene terephthalate]. They get recycled. In the past, they got disposed as a mixture and combusted in the waste incineration plant. Today, however, [...] the waste is sorted on the spot and brought to recycling.” (IP:23)</p> <p>“We control the wastewater of industrial operations that pipe their wastewater into the sewer system, the wastewater treatment facility, and the [river]. Therefore, there is the necessity to cooperate [with the manufacturer]. [...] laundry detergents are common ingredients of the municipal wastewater. In our specific context, we sometimes have higher concentrations [of laundry detergents and their ingredients such as surfactants] because of the [nearby] production processes, and especially because of the general reduction of industrial and domestic wastewater. [...] The amount of water decreases, therefore, the concentration increases. [...] We made an agreement with the detergent manufacturer in terms of not exceeding a maximum amount of wastewater at certain times of the day when we have low levels of wastewater in general. [...] High concentrations of surfactants in the wastewater] have the effect of foam formation. [...] The foam formation can cause degreasing of components in the facility. Thus, the components become damaged and corroded. [...] Furthermore, the foam compromises our equipment that measures the level of wastewater as well as [maintenance] activities in the sewer system.” (IP:27)</p>	Contribution toward a circular economy
Interplay	<p>“The manufacturing of laundry detergents involves the processing of fats; primarily vegetable fats in the final product that are biologically well degradable. We made a public agreement that allows [the manufacturer] to pipe a higher amount of fats into the sewer system. [...] These vegetable fats become] food for our biology [and bacteria] that we use for nitrogen elimination. That means the nitrogen compounds in the wastewater are eliminated and transformed into atmospheric nitrogen. [...] compared to other wastewater treatment facilities, we do not need to conduct alcohol into the wastewater. [...] Thus, we get the food used for the nitrogen elimination for free, so that [...] we have a win-win relationship.” (IP:27)</p>	Cooperation on end-of-life responsibility
Meaning	<p>“The contributions to sustainability, not only at the level of laundry detergents, but also [at the organizational level of the manufacturer]. Yes, that creates a certain satisfaction. [...] when I see that I can make a difference with my work. [...] and the [positive] feedback on my work is surely a social indicator that results in satisfaction or joy at work. [...] If you create a climate that innovation is wanted, that improvements are wanted, then I would say that I like to work here because I know that my work makes a contribution.” (IP:23)</p>	Satisfaction and subjective wellbeing

From an overarching perspective encompassing all life cycle stages, the IPs' verbal descriptions of how they perform their daily practices and routines point to an overall relative prevalence of practice elements. The most prevalent practice elements are things, followed by interplay and competence with a medium prevalence, whereas body, meaning, time, and space are the least prevalent practice elements addressed by the IPs. Practice theory argues that practitioners carry out (i.e., perform) practices by combining and integrating the practice elements (Røpke, 2009). Therefore, the relative prevalence of the practice elements determines how much emphasis the practitioners put on the practice elements when they perform their routines that aim at contributing to sustainable development. Consequently, taking the illustrative quotations along the life cycle into account (see Tables 14 to 19), the performances that aim at positive contributions to sustainable development are mainly characterized by the following aspects: First, an emphasis on aspects related to the final product of laundry detergents (e.g., functional performance, affordability, and quality of ingredients; i.e., focus on the things element). Second, an emphasis on collaborations to promote sustainable development along the life cycle (e.g., cooperative engagements in terms investments in developing countries, standard setting, or end-of-life responsibility; i.e., focus on the interplay element). Third, by an emphasis on promoting skills and knowledge about sustainable production and consumption (e.g., through sustainable customer education; i.e., practice element of competence).

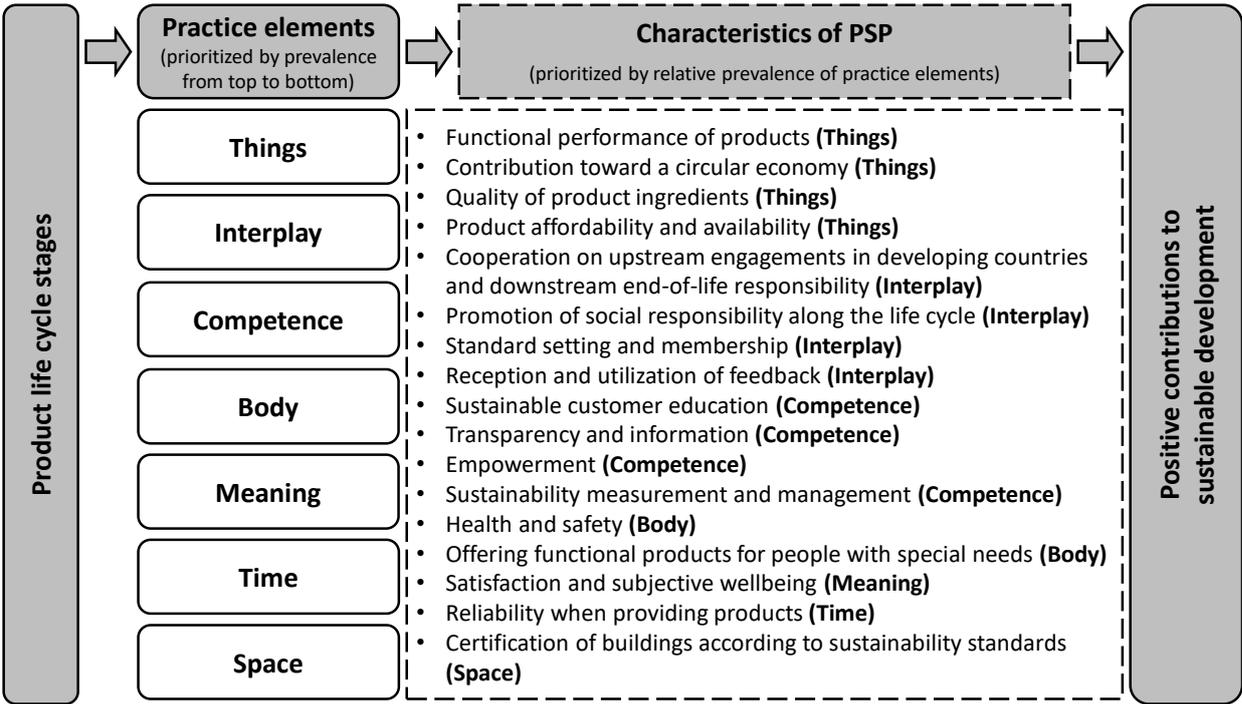
5.5. Discussion

For the following discussion, Figure 9 synthesizes the results into a conceptual framework illustrating that the routines throughout the product life cycle determine an overall relative prevalence of practice elements (with things, interplay, and competence as the most prevalent practice elements, at the top of the framework). In turn, the relative prevalence of the practice elements determines how practitioners perform their characteristic daily routines that aim at

positive contributions toward sustainable development (i.e., characteristics of PSP). This framework represents a first step toward a universal understanding of PSP. Thus, it will help future research to characterize positive contributions to sustainability more precisely.

The discussion following below is structured along the most prevalent practice elements (i.e., things, interplay, and competence) to investigate the framework of PSP characteristics in the light of practice theory. Furthermore, the most prevalent PSP characteristics (per practice element) will be placed in the context of existing knowledge on life cycle sustainability assessment and industrial ecology to discuss the rationale and importance of assessing the PSP characteristics. Thus, this discussion will contribute to establish a foundation for the future development of general measures and indicators that clearly reflect PSP.

Figure 9. Framework of positive sustainability performance



5.5.1. Things

Performing practices often requires using particular things in a certain way (Reckwitz, 2002). In this case study of the laundry detergents industry, the IPs emphasize the importance of PSP characteristics related to final product and ingredients when talking about the practice

element of things. Schaubroeck and Rugani (2017) argue that the *functional performance* of products (or industrial systems) is the most important aspect to consider when investigating sustainability benefits because products usually aim to provide benefits that fulfill human needs. In the case example of laundry detergents, the IPs point to the function of restoring dirty clothing back to its original, clean, and hygienic condition, thus providing a health benefit. However, researchers from the field of industrial ecology and life cycle assessment (LCA) criticize current approaches to define a products' function (via the functional unit) as overly simplistic and static because definitions of the functional unit typically neglect explicit descriptions of how products make positive contributions to sustainable development (e.g., Kim, Kara, & Hauschild, 2017; Schaubroeck & Rugani, 2017). Defining the functional performance of products needs to go beyond the mere quantification of impacts on humans and ecology (Schaubroeck & Rugani, 2017). Instead, it requires explicit, comprehensive, publicly available narrative descriptions of how using a product contributes to sustainable development. For example, Schaubroeck and Rugani (2017) propose to integrate narrative elaborations of the “indirect economic profit of keeping people healthy” (p. 9), whereas Kim et al. (2017) suggest a description of basic performance features to reach a neutral level of satisfaction (or dissatisfaction if the product performs poorly; e.g., price per functional unit; or reliable stain removal at 30 degree Celsius by using a laundry detergent) and more subjective excitement features that aim at generating high satisfaction by offering new possibilities and benefits to fulfill consumers' needs (e.g., support textile protection and durability, time savings when washing, or fresh scent).

In addition to the importance of addressing a product's functional performance, the IPs emphasize the importance of *contributions toward a circular economy* to improve the production and consumption of laundry detergents. Haupt, Vadenbo, and Hellweg (2017) conceive the concept of a circular economy as “a production and consumption system with

minimal losses of materials and energy through extensive reuse, recycling, and recovery” (p. 615). Contributions to a circular economy depend on the materials processed in a product and are thus case specific (Haupt et al., 2017). In the case example of laundry detergents, the IPs point to amount and ratio of renewable materials and recyclable waste (i.e., secondary material) as relevant indicators related to the circular economy concept. However, Haupt et al. (2017) argue that currently used recycling rates typically address open-loop recycling (i.e., secondary material is used to manufacture a product that is not the same as the preceding product). Therefore, they regard current open-loop recycling rates as inadequate to describe environmental benefits because they fail to describe how much material is actually kept within the same material cycle (Haupt et al., 2017). Consequently, assessing contributions to circular economy requires a transition closed-loop recycling (i.e., recycling of secondary material into the same product). Valid closed-loop recycling rates require additional detailed information about the final destination of secondary material (Haupt et al., 2017). Furthermore, establishing indicators that capture the effects of recycling networks can be a starting point for companies along the supply chain can trigger sustainability-oriented cooperation (Posch, 2010).

5.5.2. Interplay

Practice theory emphasizes the necessity of cooperation, coordination, and discourse (i.e., the interplay) between actors to perform practices (Reckwitz, 2002) that aim at the positive contributions to sustainable development along the life cycle. In the case of laundry detergents, the IPs specifically highlight PSP characteristics related to *cooperation on upstream engagements in developing countries and downstream end-of-life responsibility*. The fields of industrial ecology and industrial symbiosis consider collaboration (i.e., cooperative group efforts that aim to achieve goals which the individual institutions often pursue in their self-interest) as key factors to achieve symbiotic sustainability benefits for business and society (Lombardi & Laybourn, 2012). However, research and practice continuously overlook

collaborative opportunities because the area of interfirm coordination and management remains underdeveloped (Chertow & Ehrenfeld, 2012).

Only a few notable exceptions engage in measuring and assessing the relationship between cooperation and industrial symbiosis. For example, in terms of interfirm recycling activities, Posch (2010) shows that downstream cooperation (e.g., for environmental and human rights protection) in the use and disposal stages is a more beneficial area of collaboration (to close recycling loops) than upstream sustainability-oriented cooperation with suppliers of inputs throughout the value chain. Zhu, Geng, and Lai (2011) assess how helpful supply chain cooperation is to contribute to the circular economy practices and improving environmental and economic performance. They argue that supply chain cooperation has important positive moderating (supply chain cooperation can strengthen the relationship between independent circular economy practices and the dependent sustainability performance outcome) and mediating (supply chain cooperation is necessary for the independent circular economy practices to influence the dependent sustainability performance outcomes) effects to establish a circular economy (Zhu et al., 2011). Boons and Spekkink (2012) assess how the factors of institutional capacity affect the development of symbiotic linkages between firms. They conclude that mobilization capacity (i.e., the ability of actors to activate relevant firms and other parties to develop symbiotic linkages) is a more important trigger of industrial symbiosis compared to the other factors of relational capacity (to reduce transactions costs) and knowledge capacity (i.e., the competence to acquire and use information about feasible symbiotic linkages; Boons & Spekkink, 2012).

5.5.3. Competence

Competence involves skills and knowledge needed to perform practices (Reckwitz, 2002) that aim at the positive contributions to sustainable development along the life cycle. In terms of the production and consumption of laundry detergents, the IPs emphasize the importance of

PSP characteristics related to *sustainable customer education* to support customers' and consumers' decision making when buying, using, and disposing products. Although the impact of sustainability information on consumer decision making is a critical area in the field of industrial ecology research, little is known in terms of how sustainability information (provided by LCSA) motivate consumers to make sustainable choices when buying, using, and disposing products (O'Rourke & Ringer, 2016). Specifically, the field lacks knowledge regarding the relative importance of concrete LCSA indicators to change consumer behavior toward making sustainable product choices. Researchers argue that economic information, especially the price and life cycle costs (e.g., Kaenzig & Wüstenhagen, 2010) of a product are the most important aspects determining consumer behavior, because other information (e.g., chemical risk information) is often too technical and inaccessible (e.g., Fransson et al., 2013). Besides economic information, only health related information have a certain influence on consumers' decision making, whereas particularly ecological information and indicators (e.g., about climate change) are often too difficult for consumers to process (O'Rourke & Ringer, 2016). Therefore, O'Rourke and Ringer (2016) argue that "simply providing more or better information on sustainability issues will likely have limited impact on changing mainstream consumer behavior" (p. 882). Consequently, Lemke and Luzio (2014) argue that academics and business should intensify efforts to understand the factors that determine consumer skepticism (e.g., in terms of greenwashing) with information delivery systems before being able to provide relevant information. Thus, research and practice can build a foundation to make sustainability information more accessible to consumers.

5.6. Conclusion

This paper offers valuable findings and contributions for research in the fields of industrial ecology and life cycle sustainability assessment. First, this paper contributes by introducing the theoretical anchor of practice theory to explore how performing practices of industrial

production and consumption constitute phenomena such as positive contributions to sustainable development. Thus, practice theory provides a valuable lens to identify and analyze relevant criteria to assess sustainability performance. Second, by conducting interviews with actors along the entire life cycle of laundry detergents, this paper answers the frequent call of involving actors from all stages of a product chain in empirical industrial ecology research. Third, the paper contributes by explaining how the various life cycle stages determine the relative prevalence of the practice elements addressed by the interview partners. Thus, building on these qualitative empirical insights, this paper answers the research question by identifying and prioritizing a set of characteristics that constitute PSP along product life cycles and corporate supply chains. Fourth, this paper contributes by synthesizing and discussing a framework of PSP characteristics representing a first step toward a universal understanding of how industrial production and consumption contribute to sustainable development. Furthermore, by discussing the most prevalent characteristics of PSP in the light of extant industrial ecology literature, this paper establishes a foundation for the future development of general measures and indicators that clearly reflect PSP.

The findings of this paper have several implications for future research avenues. The empirical framework and prioritization of PSP characteristics presented is based on the case of the laundry detergent life cycle. Therefore, future researchers can use the framework as starting point for testing, and complementing the comprehensiveness of PSP characteristics in other case study contexts, or in a cross-product research setting. Furthermore, the presented framework and prioritization of PSP characteristics build on qualitative reasoning. Therefore, future researchers can validate the prioritization of the PSP characteristics by using more quantitative research method (e.g., by conducting surveys or Delphi studies with experts to rate the relative importance of PSP characteristics). Finally, this paper could only discuss the most prevalent PSP characteristics. Therefore, future researchers can investigate the remaining

characteristics and develop valid measurement approaches and indicators. Overall, this paper provides an important step to measure and ultimately manage PSP. Thus, it establishes a foundation for the development of sustainable business practices that go beyond merely counteracting negative business outcomes toward actually delivering sustainability benefits for business and society.

6. Fifth study: “Contributions to the sustainable development goals (SDGs) in life cycle sustainability assessment: Insights from the Handprint research project”²¹

Abstract. The United Nations’ Sustainable Development Goals (SDGs) represent consensual targets on a global scale encouraging not only the fight against unsustainable aspects in society (e.g., poverty or hunger) but also positive contributions to sustainable development (e.g., promotion of renewable energy or human well-being). Sustainability management research and practice increasingly incorporate life cycle thinking to assess ecological, economic, and social impacts along product life cycles and supply chains. Life cycle thinking often focuses on becoming less unsustainable while neglecting outright positive contributions to sustainable development. Therefore, the SDGs can help businesses to broaden the view to assess their positive contributions to sustainable development. However, they are not per se designed as a performance measurement system. Consequently, research is challenged to develop convincing approaches and indicator systems that capture how businesses contribute to the SDGs.

This paper presents findings of the “Handprint” project, which aims at, first, analyzing and synthesizing the status quo of assessing positive contributions to sustainable development in

²¹ The fifth study has a working paper status (co-authored with Samanthi Luisa Silva, Prof. Dr. Rüdiger Hahn, Prof. Dr. Stefan Schaltegger, Dr. Ulrike Eberle, Marianne Schmid, Janpeter Beckmann, and Christoph Hermann).

research and practice. While a “footprint” measures negative ecological and/or social impacts, the “Handprint” measures positive contributions to sustainable development. Second, this paper identifies and prioritizes core assessment categories and indicators. Third, it develops and tests a sustainability assessment approach to evaluate positive contributions to sustainable development at the product level. This paper documents methodological developments of the research project and extends the focus from reducing unsustainable, negative business practices toward striving for positive contributions to sustainable development in sustainability assessment and management.

6.1. Introduction

Sustainability management research and practice increasingly incorporates integrated life cycle thinking (Guenther & Schneidewind, 2017; Rieckhof, 2017) to assess the ecological, economic, and social damages and benefits along product life cycles and corporate supply chains (e.g., Blass & Corbett, 2017; Di Cesare et al., 2016; Ekener et al., 2016; Maas et al., 2016b; Schaltegger & Burritt, 2006). So far, however, life cycle thinking often focuses on becoming less unsustainable instead of assessing positive contributions to sustainable development (Hacking & Guthrie, 2008; Sala et al., 2013b). (George, 2001) argues that a focus on solely mitigating negative sustainability problems is an important objective, but lacks ambition resulting in only marginal contributions to sustainable development. Therefore, (Sala, Farioli, and Zamagni, 2013a) posit that life cycle sustainability assessment (LCSA) “should be shifted from avoiding negative impacts to also proactively enhancing positive impacts” (p. 1666). A shift from assessing negative outcomes to societal and environmental benefits would contribute to recognizing and realizing win-win opportunities for business and society (Di Cesare et al., 2016). Such win-win opportunities can be achieved by a product responsibility approach that moves from minimizing harm to maximizing positive sustainability benefits (e.g., the restoration of nature; Rost, 2015).

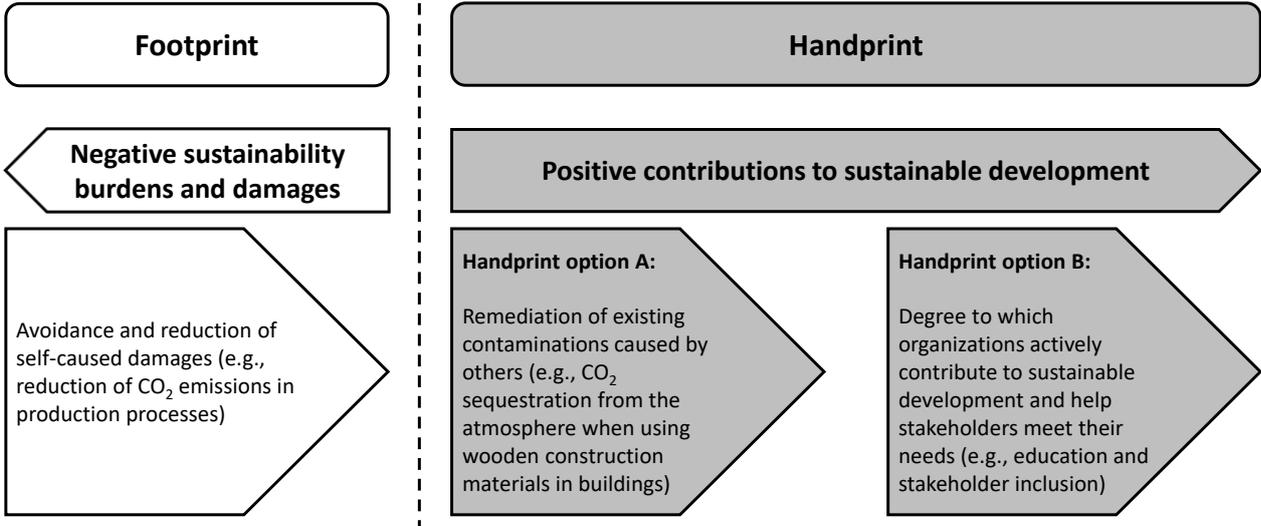
Currently, however, extant scientific literature largely neglects positive contributions to sustainable development. While a number of researchers relate positive aspects to the social dimension (e.g., Ekener et al., 2016; Kroeger & Weber, 2015), potential positive economic and ecological aspects are barely covered. Furthermore, there is no consensus on what generally constitutes a positive contribution to sustainable development (Ekener et al., 2016). Therefore, (Di Cesare, Silveri, Sala, and Petti, 2016) suggest the United Nations' (UN, 2015) Sustainable Development Goals (SDGs) as a suitable and universal reference framework for capturing contributions to sustainable development. The SDGs encourage not only the fight against unsustainable aspects in society (e.g., poverty or hunger) but also positive contributions to sustainable development (e.g., promotion of renewable energy or human well-being; UN, 2015; Verboven & Vanherck, 2016). Although the SDGs represent consensual targets on a global scale when pursuing positive contributions to sustainable development (Schaubroeck & Rugani, 2017), they are not per se designed to evaluate contributions at organizational or product level (Kühnen & Hahn, 2017). Consequently, research is challenged to develop convincing approaches and indicator systems that capture how businesses and their products contribute to the SDGs (Verboven & Vanherck, 2016).

Another frequently discussed problem in the field of LCSA relates to the differing maturity levels of the three elements of LCSA (e.g., Corona et al., 2017; Kloepffer, 2008). LCSA has significantly advanced in the ecological dimension since the International Standardization Organization (ISO) published the first 14040 standard series in 1997 on environmental life cycle assessment (ELCA) of products (reviewed and further developed in 2006; ISO, 2006). However, despite the publication of a standardized framework, "it leaves much to interpretation" (Curran, 2013, p. 273). Early notable efforts to assess sustainability holistically at the product level include, for example, the product sustainability assessment approach (PROSA) by Grießhammer et al. (2007) or the SEEBALANCE approach developed by BASF

(Saling, 2017). However, Arcese et al. (2016) conclude that none of these early approaches reached a consensual predominance over the others, so that the field has become fragmented.

Furthermore, in contrast to the product level focus of ELCA, research on life cycle costing (LCC) and social life cycle assessment (SLCA) often relates economic and social aspects to the organizational level (e.g., Burritt & Schaltegger, 2014; Dreyer et al., 2006; Martínez-Blanco et al., 2015). Consequently, the assessment of economic and social sustainability at the product level remains at a developmental stage (Finkbeiner, Schau, Lehmann, & Traverso, 2010; Fontes et al., 2016). Thus, the overall field of LCSA is, first, incomplete as it fails to address positive contributions to the SDGs, and second, imbalanced in terms of integrating the three sustainability dimensions at the product level. Triggered by the incompleteness and imbalance of the LCSA field, a group of researchers initiated the Handprint research project in 2013. The Handprint addresses positive contributions to sustainable development, whereas established footprint (e.g., Wackernagel & Rees, 1996) approaches measure negative ecological and/or social impacts. Figure 10 provides a differentiation of the rationale of the Handprint compared to established footprint approaches.

Figure 10. Rationale of the Handprint



This paper presents the methodological steps of the research project, describes the Handprint assessment approach, and discusses its key contributions. Thus, we put the assessment and evaluation of positive contributions to the SDGs into practice. Furthermore, we contribute to the field of LCSA by shifting the established focus from primarily considering negative aspects toward integrating positive aspects as well. Overall, the research aims of the Handprint project include:

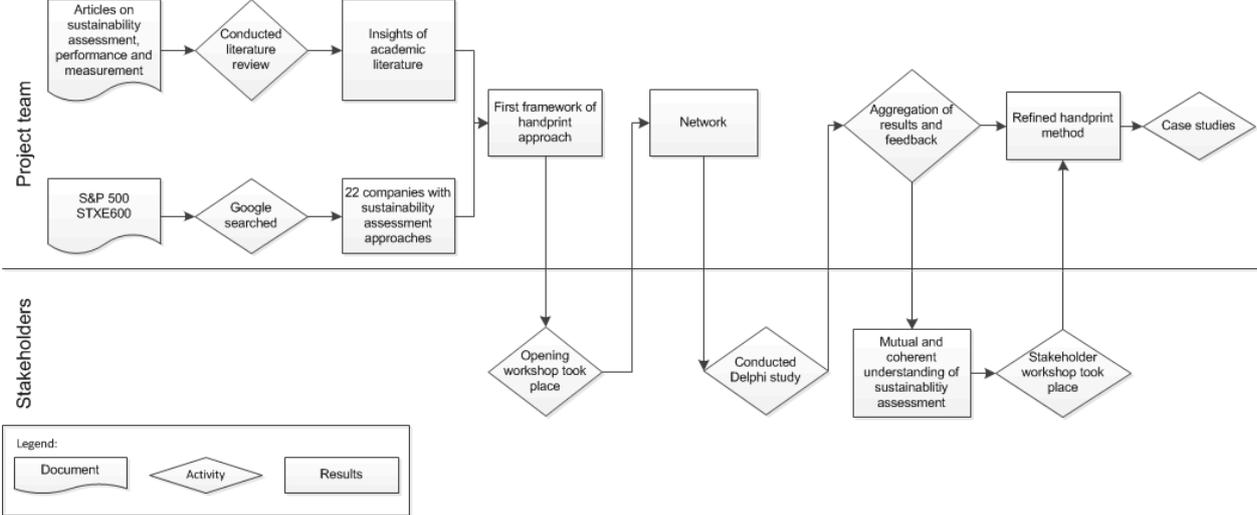
- (1) Reviewing the assessment of positive contributions to sustainable development in research and business practice.
- (2) Identifying positive sustainability indicators.
- (3) Developing an evaluation approach that expresses relations between the indicators selected and positive contributions to sustainable development.
- (4) Testing and validating the Handprint approach in case studies.
- (5) Sharing our insights with business practitioners, scholars, political actors, and non-governmental organizations.

6.2. Methodological steps of the research project

The Handprint project was based on a multi-method approach (Burks & Krupka, 2012; Zellmer-Bruhn & Gibson, 2006) to develop a comprehensive and practically feasible method for assessing and evaluating a product's positive contributions to sustainable development. The core research question was: What positive sustainability contributions occur throughout the life cycle of a product and how can they be assessed and evaluated? The approach involved reviews of extant literature, corporate practice, and external reference frameworks. Furthermore, it was based on iterative expert judgements from a two-pronged Delphi study, participatory stakeholder workshops, and the application and testing of the Handprint approach in case studies. Figure 11 displays the individual research steps of the multi-method approach,

describes the actions taken, and shows the interim-results. It also highlights the iterative approach of the project.

Figure 11. Overview of the multi-method approach



The combination of several systematic analyses created a comprehensive and broad overview of the status quo in the sustainability assessment field. The insights from the reviews of literature and practice formed the starting point for the development of the Handprint approach. The reviews were followed by a two-pronged Delphi study and accompanied by stakeholder workshops. The Delphi study and stakeholder workshops offered a platform for the consideration of different expert claims and opinions for the development of the Handprint. The multi-method-approach includes constant feedback from external stakeholders to support the development of a scientifically sound and practice-oriented assessment approach. Finally, the Handprint approach is tested and validated in case studies. The following sections document the individual steps of the multi-method approach.

6.2.1. Systematic literature reviews

The systematic review of academic literature dealing with sustainability assessment and measurement provided the foundation for the further research steps. It followed the research approaches suggested by Denyer and Tranfield (2009) and Tranfield et al. (2003). The

systematic review provided an overview of various sustainability assessment methods at the company level and product level, an analysis of the scholarly understanding of positive contributions to sustainable development, and a first extraction of indicators that claim to capture positive contributions to sustainability.

6.2.2. Review of sustainability assessment approaches in companies and external reference frameworks

In addition to the systematic review of academic literature, an analysis of sustainability assessment methods from corporate practice was conducted. For this practice review, the research approach for conducting a systematic literature review suggested by Denyer and Tranfield (2009) was adapted. To identify cases from corporate practice, companies listed in the Standard & Poor's 500 (S&P 500) and Stoxx Europe 600 (STXE 600) indices (as of 30 January 2015) were reviewed to reveal if any of those companies developed their own proprietary sustainability assessment approaches. 22 sustainability assessment approaches from corporate practice were identified. All of these companies publicly claimed to use a sustainability assessment approach that integrates social, environmental, and economic indicators. These approaches applied in corporate practice were analyzed in terms of the development of indicators that address positive contributions to sustainable development.

To complement the systematic review of research and practice, we additionally reviewed external reference frameworks. Particularly, we reviewed the UN (2015) SDGs, the ISO (2006) 14040 standard series on ELCA, the guidelines and methodological sheets for SLCA published by the United Nations Environment Programme and Society of Environmental Toxicology and Chemistry (UNEP & SETAC, 2009, 2013), the Vision 2050 framework by the World Business Council for Sustainable Development (2010), the better life index and green growth initiative the Organisation for Economic Co-operation and Development (OECD, 2017b, 2017a), the

Economics of Ecosystems of Biodiversity (2017), and the World Resources Institute (2012) report on corporate ecosystems services.

6.2.3. Delphi study

Building on the insights of the systematic review of academic literature and corporate practice, a two-pronged Delphi study with experts in the field of life cycle assessments was conducted. The aim was to achieve a comprehensive and coherent understanding of important social aspects and positive sustainability aspects to be considered in product sustainability assessment. In general, the Delphi method aims at structuring a group communication process in which a group of individuals deals with a complex problem. It is an anonymous, iterative multi-round survey process, in which the moderator provides feedback of the group opinion to the participants after each round (Linstone et al., 2002). Schmidt (1997) outlines a structured approach of the implementation of a Delphi study, which was applied in the research project.

The same pool of experts from academia, corporate practice, and civil society with substantial experience in life cycle assessment, sustainability assessment, and sustainability was invited to participate in the two parallel Delphi inquiries on social sustainability assessment and positive sustainability assessment. The two parallel inquiries followed the same procedure. The first round started with open qualitative questions asking what the most important aspects, criteria, and indicator for measuring social and positive sustainability performance along product life cycles and corporate supply chains are. After this brainstorming round, qualitative content analysis (Mayring, 2010) was used to inductively (Seuring & Gold, 2012) evaluate and code the open survey responses into recurring aspects. We consolidated the open responses into a list of several items (i.e., aspects to consider when assessing social and positive sustainability performance). In the second round, the experts quantitatively rated the importance of each item. Subsequently, the ratings of each respondent were aggregated into a group response. For the third and final round, the participants were provided with aggregated group responses to reflect

the group opinion, and then, to finalize their rating of each item. Overall, the two-pronged Delphi approach achieved a coherent understanding of the core aspects for the assessment of social and positive sustainability.

6.2.4. Participatory stakeholder-workshops

Throughout the project, stakeholder workshops were conducted to present the status quo of the project to experts and receive iterative feedback. The discussions with the stakeholders revealed how companies—aware and unaware—already dealt with positive sustainability effects and their assessment. Furthermore, the stakeholders described their expectations on the Handprint approach and provided critical reflections based on personal experience.

6.2.5. Case studies

The preliminary Handprint approach is being tested in case studies of selected products in cooperation with industry partners. For this purpose, case study partners from three different sectors (home furnishing, electronics, and dairy products) with end-consumer (rather than business-to-business) products were selected. The aim of the case studies is to test the practicability of the Handprint approach, identify its limitations, and reveal opportunities for further refinement. The presentation of the case study results is not subject of this paper.

6.3. Results

6.3.1. Findings and implications from the systematic review of research and practice: Analysis and synthesis of research and practice on assessing positive contributions to sustainable development

The systematic review of the academic literature revealed a limited number of publications explicitly dealing with positive contributions to sustainable development. A few early references in the sustainability assessment field criticize management scholars' and practitioners' ambition to deliver positive contributions to sustainable development (George,

2001) for their negative perspective on sustainable development (e.g., as a necessary and costly evil to maintain legitimacy; Hart & Milstein, 2003). From around 2005 on, first noticeable contributions introduce the conceptual foundation of positive contributions and benefits into sustainability assessment research. Norris (2006) develops and demonstrates the methodology of a life cycle attribute assessment to estimate the potential health benefits resulting from economic activities. Benoît et al. (2010) emphasize that positive benefits can play a major role in SLCA, compared to their marginal role in current ELCA. Several authors suggest generic aspects to assess positive sustainability benefits including the promotion of biophysical system integrity (Gibson, 2013), regeneration of the environment (Pauw et al., 2014), promotion of a circular economy (Haupt et al., 2017), and the functional value of products to contribute to human well-being (Schaubroeck & Rugani, 2017). Some authors even propose more concrete frameworks and indicators that aim at delivering a positive transition to sustainability. Neugebauer et al. (2014) elaborate on a cause-effect relation between the payment of fair wages and the level of education, which positively or negatively affect human well-being. Schaltegger and Burritt (2014) propose indicators of efficiency, consistency, and sufficiency to contribute to a positive sustainability transformation of markets and society.

In terms of empirical experience and case study research, a few researchers provide empirical insights into positive sustainability benefits of airbags (Baumann et al., 2013), laptop computers (Ekener-Petersen & Moberg, 2013), mobile phones (Wilhelm et al., 2015), and solar power generation (Corona et al., 2017). Ekener et al. (2016) investigate the possibilities of addressing positive impacts in SLCA using the case of vehicle fuels. They emphasize problems in determining what should be counted as a positive impact. Correspondingly, Hacking and Guthrie (2008) conclude that deciding whether sustainability impacts are positive or negative is problematic, since such decisions often involve subjective value judgements. In turn, this

problem underlines the importance of a globally consensual reference framework such as the SDGs.

Overall, despite a few notable efforts to describe positive contributions to sustainable development, a clear definition or joint understanding of what constitutes positive contributions to sustainable development is missing in extant literature. Due to the limited findings in the academic literature, we additionally reviewed initiatives from business practice, to investigate if there are any prominent approaches to capture and assess positive sustainability benefits. Overall, the systematic review of business practice revealed that the majority of the 22 identified practice cases claims to integrate positive benefits aspects into sustainability performance measurement. Table 20 provides an overview of the identified 22 companies including the respective indicators used to assess positive contributions to sustainable development.

Table 20. Overview of indicators used in business practice to assess positive contributions to sustainable development

Company name and designation of sustainability performance measurement approach	Identification via share indices	Indicators used in business practice to assess positive contributions to sustainable development
3M Company – Life Cycle Matrix	S&P 500	Selection of hard goods components that meet high safety performance standards; customer training programs for safe and effective product use; installation of safety devices
Clorox Company – Preferred Ingredient Calculator	S&P 500	Transparency and product information (e.g., on the appropriate use, storage and disposal); animal welfare and pet safety
Colgate-Palmolive – Product Sustainability Scorecard	S&P 500	Responsible sourcing and raw materials
Delphi Automotive – Manufacturing Capability Assessment	S&P 500	Existence of a documented process for ensuring health and safety (H&S) of all employees at suppliers; process audited in compliance with all applicable requirements, including an emergency plan; health and safety related information tracked and communicated throughout the organization on a regular basis
Dow Chemical – Sustainability Footprint Tool	S&P 500	Improved biodiversity; access to telephone networks and the internet; access to (renewable) electricity; access to markets including improved transportation infrastructure: use of the product must be relevant to the needs of the citizens of emerging economies; cost of the product must be affordable (not prohibitively expensive); life cycle knowledge (extent of current knowledge to list the main operational stages of the life cycle); value chain process safety; potential to address world challenges (healthier drinking water, affordable housing; improved food production; improved personal/public health; improved (end user) safety
Food Machinery Corporation (FMC) – Sustainability Assessment Tool	S&P 500	Human health promotion
Ford – Product Sustainability Index	S&P 500	Mobility capability (luggage compartment volume plus weighted number of seats related to vehicle size) to support life in crowded cities; affordability (life cycle ownership costs); safety
Johnson & Johnson – Earthwards	S&P 500	Use of fair-trade materials; selection of socially responsible suppliers; supporting causes with clear social benefit
Marriott International – Supplier Sustainability Assessment Program (MSAP)	S&P 500	Selection and development of socially responsible suppliers; fair labor and human rights practices
Procter & Gamble – Product Sustainability Assessment Tool	S&P 500	Creation of alternative ways to meet needs; time gains; ingredient specific safety; economic consumer benefit; social responsibility along the supply chain (compliance with international vendor assessment system); sustainable product use instructions; donation of patents; health benefits; job creation

Table 20. Continued

Starbucks Coffee Company – Coffee and Farmer Equity (C.A.F.E.) Scorecard	S&P 500	Workers’ access to housing, potable Water, and sanitary facilities; workers’ access to education; worker safety and training; provision of personal protective equipment; workers’ access to medical care; wages and related benefits; freedom of association and collective bargaining
Target Corporation – Sustainable Product Standard	S&P 500	Transparency of product labeling
Wal-Mart – Sustainability Index	S&P 500	Cooperation of suppliers with further upstream suppliers concerning social issues and documentation corrections and improvements; suppliers’ local community development activities; existence of a social compliance management system at suppliers; knowledge about the location of facilities throughout the supply chain
Alcatel-Lucent – Sustainability Impact Analysis	STXE 600	[No indicators addressing positive contributions to sustainable development included]
BASF – SEEbalance	STXE 600	Extra product-benefits that enhance customer satisfaction (e.g. service, increase in leisure time, low noise); fair trade labels; imports from developing countries; completeness and quality of product information (about origin, ingredients, use, potential dangers, side-effects, etc.); consumer labels; number of trainees; expenditures for professional training and continuing education; product-benefits for disadvantaged people (e.g. disabled, sick, poor) due to product qualities; wages and salaries; company expenditures for family support; company expenditures for social security; company benefits such as housing subsidies, workforce facilities, payments in kind and cafeteria subsidies; number of employees; number of unskilled workers (qualification of employees); number of female managers; number of disabled employees; expenditures for research and development
Bayer – Sustainability Check	STXE 600	Product value for society; employee safety; customer and consumer safety; public acceptance of the product
Berkeley Group – Social Sustainability Framework	STXE 600	Local facilities (about having access to the facilities people need for health, education and a social life); community space (about the design and management of public space and providing community facilities when it is appropriate); transport links (about helping people travel easily and sustainably); local integration (about connections to the surrounding area and ways to encourage social interaction); street layout (about creating places that are easy to move around and navigate); adaptable space (about creating public space that can be used flexibly now and could change easily in future); ability to influence (about whether people feel they can really affect decisions about their neighborhood, if they choose to get involved); local identity (about creating a place where people feel like they belong and where they hope to stay); links with neighbors (about creating a place where people know their neighbors and trust each other); wellbeing (about people's experiences and their life satisfaction); feelings of safety (about whether crime is low and residents feel safe both during the day and at night); willingness to act (about creating a community in which people work together to manage and improve the neighborhood); distinctive character (about creating a place that feels unique)

Table 20. Continued

Deutsche Telekom – Sustainability Compass	STXE 600	Contribution of the product to the guarantee and enhancement of free access to information; product quality (fitness for use, ease of use); universal use of devices (standardization of connections and software); guarantee of data protection and protection of private sphere when using the product; support of socially acceptable use of the product; contribution of the product to the improvement of living conditions of the individual and/or general public (health, well-being, educational opportunities, nationwide broadband provision); contribution of the product to the improvement of work and life balance, social cohesion, cultural diversity, democratic processes and institutions; contribution of the product to the promotion of equal rights, equal opportunities, personal opportunities of the individual; product designed to cover basic human needs and/or needs that benefit society as a whole; adherence to the company’s social charter throughout the entire value-added chain including suppliers (fundamental right to freedom of association, adequate remuneration, minimum standards in employment and health protection, prohibition of exploitative child labor); quality and accessibility of customer service; customer information (on charges for services and possible subsequent costs, product information on devices, adoption of common labels, labeling for constituents, recyclability, energy efficiency); communication of protective measures (measures for minimizing radiation exposure, government health warning for mobile phone usage by children, warning for mobile phone products with loud ring tones); socially acceptable marketing (fair and credible in accordance with the sustainability strategy, no exploitation of emergencies or customers that are not fully able to make decisions for themselves, e.g., children); product tailored to customers with special needs (e.g., senior citizens, or disabled persons), contribution of the product to long-term job creation
Henkel – Sustainability Master	STXE 600	Functional product performance; ease of use, product longevity; fairly sourced or certified ingredients; affordability; skin compatibility; consumer health and safety; health and safety of workers and value chain partners; job creation
SABMiller – Sustainability Assessment Matrix	STXE 600	Number of retailers engaged on responsibility; training days per employee; percentage of employees who have received alcohol responsibility training; percentage of female executives and managers (diversity and equal opportunity); corporate social investment spending breakdown; percentage of employees covered by trade unions and collective bargaining agreements
Solvay – Sustainable Portfolio Management	STXE 600	Healthy nutrition; availability of food; medical care; product safety throughout its entire lifecycle
Unilever – Brand Imprint	STXE 600	Nutritional value of products and nutritional information; food safety; hygiene improvements

Although the validity of the specific indicators used can be criticized for being overly generic, this points to the increasing importance of assessing positive contributions to sustainable development in business practice. Furthermore, the results of the systematic practice review point to significant inconsistencies in the use of positive indicators due to the lack of suitable standardized frameworks that guide and prioritize the selection of positive sustainability indicators. Therefore, the Handprint project required to establish such a practical prioritization of indicators. Consequently, next step in the Handprint aimed at prioritizing

indicators by evaluating the opinions of various experts from the field in a two-pronged iterative Delphi study.

6.3.2. Findings and implications from the Delphi study: General prioritization of social and positive sustainability aspects

The results from the analysis and synthesis of the systematic literature and practice review point to the increasing importance of assessing social and positive sustainability performance along product life cycles and corporate supply chains. However, assessing social performance is still at a developmental stage, while assessing positive contributions to sustainable development at the organizational or product level currently lacks a sound conceptual and theoretical characterization of what constitutes positive contributions to sustainable development beyond the mere reduction of negative sustainability burdens and damages (Kühnen & Hahn, 2017). Therefore, the Delphi study first aimed at the empirical identification of relevant aspects that represent characteristics of social and positive sustainability performance. Building on the identification of relevant characteristic aspects, the Delphi study provides a prioritization of the most important aspects of social and positive sustainability performance. Table 21 presents the relative importance of the characteristic aspects of social and positive sustainability performance, and thus guides the prioritization of relevant indicators for the Handprint approach.

Table 21. Prioritization of most important aspects to consider when assessing social performance and positive contributions to sustainability

Prioritization of aspects to consider when assessing social performance		Prioritizations of aspects to consider when assessing positive contributions to sustainable development	
Items aggregated in first round	Mean values of experts' ratings from final round on nine-point-scale	Items aggregated in first round	Mean values of experts' ratings from final round on nine-point-scale
<ul style="list-style-type: none"> • Health and safety situation 8.06 • User health and safety 8.03 • Transport safety 7.59 • Consumer information for sustainable product application 7.44 • Transparency about final destination of waste and unused parts 7.31 • Suppliers' health and safety situation 7.15 • Hazardous (toxicity) potential of product specific materials 6.42 • Socially responsible waste management infrastructure 6.34 • Products' functional utility 6.28 • User education about sustainable disposal 6.25 • Legal compliance of suppliers' operations 6.18 • Life span and long-term support of sold products 5.97 • Fair pricing and affordability 5.84 • Compensation of workers (wages etc.) 5.82 • Effects of transportation on infrastructure 5.72 • Ethical advertising 5.63 • Hazardous (toxicity) potential of product-specific materials 5.59 • Suppliers' conduct towards the least (children, uneducated etc.) 5.53 		<ul style="list-style-type: none"> • Reduction of negative sustainability issues/problems (e.g., reduction of emissions, costs, accidents) 8.08 • Development of sustainable business models 7.44 • Preventive avoidance of negative sustainability issues/problems (e.g., conservation of resources, protection of species) 6.64 • Fair trading 6.52 • Completeness and quality of product information 5.96 • Contribution towards a circular economy (e.g., cradle-to-cradle product design, recyclability, reusability, reparability, upgradeability) 5.92 • Cooperation with suppliers 5.92 • Health and safety (e.g., life expectancy) 5.88 • Economic gains for individual stakeholders along the life cycle (e.g., income, wages and salaries) 5.52 • Quality of ingredients (e.g., organically sourced) 5.52 	

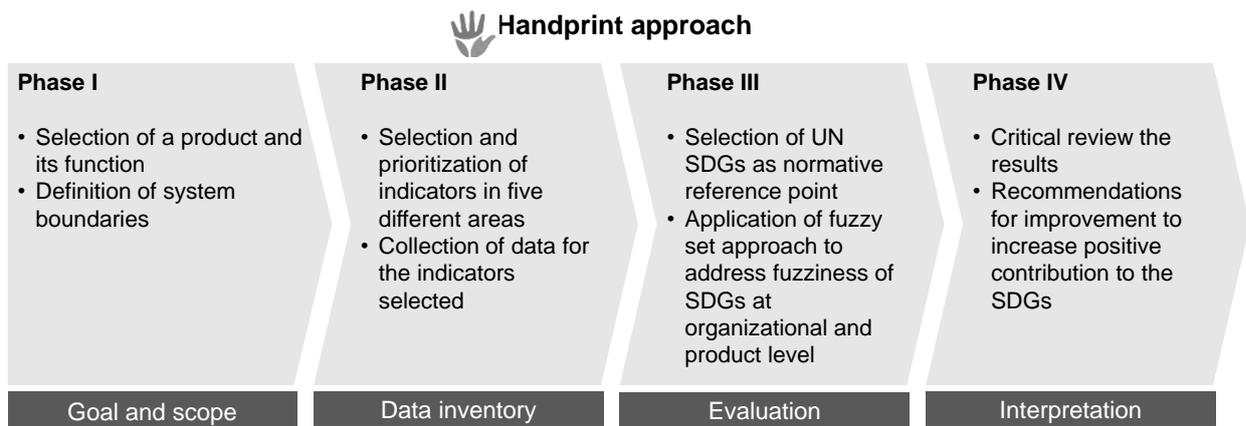
Note that the participating experts were asked to rate the importance of each item on a nine-point scale ranging from not at all important (=1) to extremely important (=9).

Building on the findings from the systematic reviews and the prioritization of social and positive sustainability performance aspects from the parallel Delphi inquiries, the project team developed and selected specific indicators and metrics in iterative internal discussions to operationalize the Handprint approach, which is introduced and described next.

6.3.3. Description of the Handprint approach

The assessment and evaluation approach of the Handprint adapts the established conceptual framework of conducting ELCA as outlined in ISO 14040 and 14044. Figure 12 illustrates the four phases of goal and scope definition, data inventory compilation, evaluation, and interpretation to conduct a Handprint assessment.

Figure 12. Illustration of the phases of the Handprint approach



First, the *goal and scope* definition phase describes the objective of the assessment as well as the product, its function, and the system boundaries (i.e., the relevant life cycle stages considered). For the *data inventory* compilation and analysis, the Handprint contains a prioritized pool of indicators allocated to five areas (i.e., social, human health, ecological, economic, and governance). Table 22 provides an overview of the 37 indicators addressing these five areas. The inventory indicators were selected through the iterative process described in the previous sections. To support the practicability and flexibility of the Handprint approach, the prioritization of social and positive sustainability aspects from the Delphi studies can guide the prioritization of the overall pool of indicators for various product cases. For these indicators, data must be collected and compiled from the companies along the products life cycle.

Table 22. Overview of preliminary Handprint indicators that address SDGs

Area	Indicators (and related SDGs)
Social aspects	<ul style="list-style-type: none"> • Average workers' wages compared to minimum wage and living wage (SDGs 1.1; 8.5) • Expenses on social security (SDGs 1.3; 8.5) • Ratio of women's wages to men's wages in different salary categories (SDG 8.5) • Integration of disadvantaged people (SDG 8.5) • Number of cases of child labor in the product life cycle (SDG 8.7) • Number of cases of forced labor in the product life cycle (SDG 8.7)
Health risk prevention	<ul style="list-style-type: none"> • Number and/or loss of time caused by accidents at work or work-related diseases (SDGs 3.9; 8.8) • Number of workers having access to protective equipment (SDGs 3.9; 8.8) • Potential for human toxicity (SDGs 3.9; 12.4) • Potential for ozone depletion (SDGs 3.9; 12.4) • Potential for ozone-smog (SDGs 3.9; 12.4) • Potential for radiation (SDGs 3.9; 12.4) • Potential for fine dust (SDGs 3.9; 12.4)
Environmental aspects	<ul style="list-style-type: none"> • Potential for terrestrial biodiversity (SDGs 2.4; 2.5; 6.6; 12.4; 15.1; 15.4; 15.5) • Volume of wastewater (SDG 6.3) • Potential for freshwater eutrophication (SDG 6.3) • Potential for freshwater toxicity (SDG 6.3) • Volume of water use (SDG 6.4) • Scarcity of water (SDG 6.4) • Land use (SDG 6.6) • Use of resources including aspects of renewable energies, energy efficiency, and resource efficiency (SDGs 7.2; 7.3; 8.4; 12.2; 12.3) • Amount of waste (SDGs 12.4; 12.5) • Potential for eco-toxicity (SDGs 6.3; 12.4) • Potential for greenhouse effect (SDG 13) • Potential for marine eutrophication (SDG 14.1) • Potential for marine toxicity (SDG 14.1) • Potential for marine acidification (SDG 14.3) • Potential for marine biodiversity (SDGs 14.4; 14.5) • Potential for soil quality (SDGs 15.3; 15.5)
Economic aspects	<ul style="list-style-type: none"> • Distribution of (technological) solutions for sustainability (SDGs 17.6; 17.7)
Governance aspects	<ul style="list-style-type: none"> • Capacity Building (SDGs 4.7; 13.3) • Investments in R&D focusing on sustainability, sustainable entrepreneurship, infrastructure, and trainings (SDGs 9.5; 17.3; 17.7; 17.16) • Sustainability (risk-) management in companies and throughout the value chain (SDGs 12.2; 12.6; 16.3) • Transparency and standards on company and product level (SDGs 12.6; 12.8) • Active communication of sustainability issues to product users (SDG 12.8) • Violation of law, e.g., in terms of anticompetitive behavior, tax evasion, violation of environmental law, violation laws for social and labor protection (SDG 16.3) • Engagement in setting sustainability standards and legislation supporting sustainable development (SDG 16.6)

In the *evaluation* phase, the Handprint project does not aim at conducting a classic “impact assessment” as proposed in ISO 14040/44. Instead, the Handprint includes an approach for evaluating a product’s potential positive contribution to sustainable development. A normative value system is required as a reference point to describe the relationship between the selected

indicators and potential contributions to sustainable development. We opted for the UN SDGs as a reference point to evaluate the potential sustainability contributions of products. The decision for the SDGs was based on an analytical comparison of different sustainability frameworks. We opted for using the SDGs, because they were adopted by the General Assembly of the United Nations and thus by representatives of almost all countries of the world. Thereby, the SDGs are a democratically legitimated and globally consensual framework. Furthermore, the SDGs address all dimensions of sustainability. However, Verboven and Vanherck (2016) note that the SDGs only partially provide hands-on and actionable criteria to capture businesses' impacts on sustainability. Therefore, after setting the SDGs as basis for evaluation, we investigated to which of the 17 SDGs (including 169 sub-goals) companies can make a clear contribution. Only some of the SDGs can be reasonably related to the prioritized selection of product indicators (e.g. through wages paid or emissions caused in the production process). The subsequent discussion section discusses this evaluation step in more detail.

Interpretation of results: Finally, the results of the Handprint approach are interpreted to identify, improve, and communicate a product's potential positive contribution to sustainable development. Thus, the Handprint aims at solving ecological and societal challenges, fostering positive changes along product life cycles, and supporting a sustainability transformation of business and society.

6.4. Discussion

6.4.1. Detailed elaboration of the evaluation approach that captures positive contributions to the SDGs

The SDGs represent consensual targets on a global scale and provide a potential normative foundation and reference point to capture positive contributions to sustainable development (Schaubroeck & Rugani, 2017; Verboven & Vanherck, 2016). However, the goals only provide

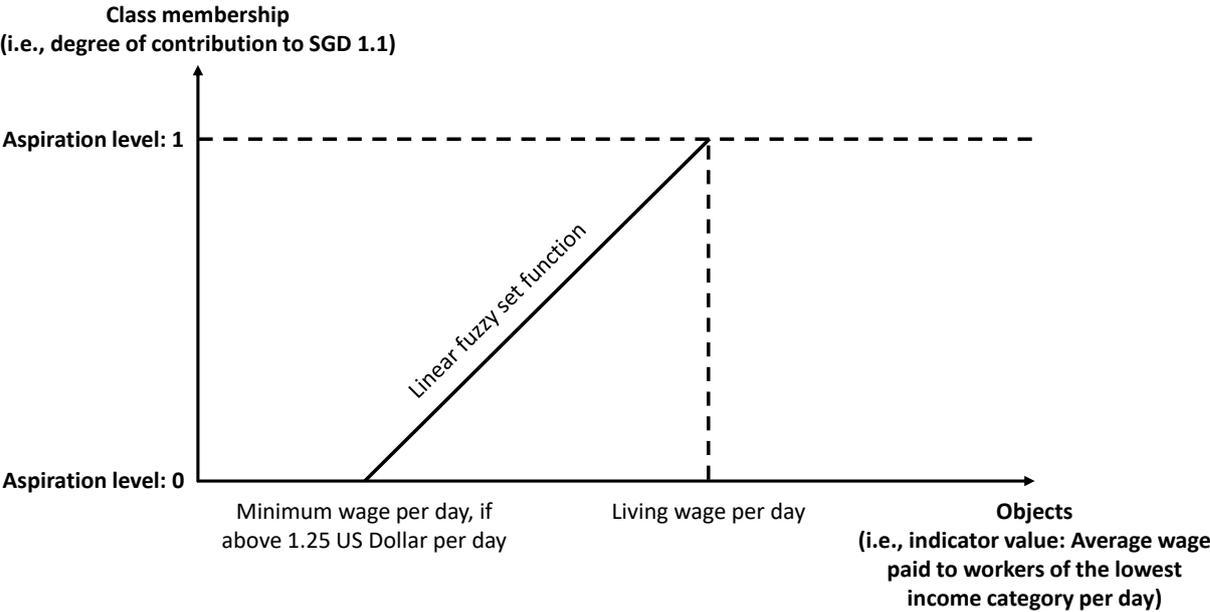
vague, imprecise, and qualitative criteria to capture and evaluate contributions to sustainable development at organizational or product level (Verboven & Vanherck, 2016). To allow for a quantified assessment, the Handprint borrows from the basic rationale to assess a product's potential impact on biodiversity proposed by Lindner (2015) who argues that biodiversity is a “fuzzy, ambiguous term and can hardly be properly defined as a political goal” (p. 6), just as many of the SDGs are. Lindner (2015) incorporates fuzzy set theory thinking (Zadeh, 1965) to define modelling functions that express the relation between a “management parameter” and its contribution to biodiversity. Correspondingly, the Handprint approach builds on fuzzy set theory (Zadeh, 1965) to establish an evaluation approach that addresses the verbal fuzziness of the SDGs for business organizations and their products, because fuzzy set theory “is particularly well suited as a bridge between natural language and formal models” (Zimmermann, 2010, p. 329).

Fuzzy set theory argues that the key element of human thinking are words and not numbers (Pavlová Dočekalová, Doubravský, Dohnal, & Kocmanová, 2017). Verbal expressions about sustainability performance are often subjective, uncertain, and vague (Govindan et al., 2013). Fuzzy set theory addresses the imprecision and vagueness (i.e., fuzziness) contained in human language, judgements, and decisions (e.g., related to contributions to sustainable development) when objects do not have precise criteria of class membership (Zimmermann, 2010). Zadeh (1965) defines a fuzzy set as “a class of objects with a continuum of grades of membership” (p. 339). For example, the class of animals includes the objects of cats and dogs, whereas the object of bacteria have an ambiguous status regarding the class of animals (Zadeh, 1965). Similarly, the class of “contributions to sustainable development” includes objects such as “paying decent and fair wages to workers”, whereas the “actual level of wages paid to workers” can be an ambiguous object regarding sustainable development.

A fuzzy set (i.e., class of objects) is characterized by a “membership function which assigns to each object a grade of membership ranging between zero and one” (Zadeh, 1965, p. 338). An object with a membership grade of one is in the set, whereas an object with a membership grade of zero is not in the set (ambiguous objects are assigned with values between zero and one; Govindan et al., 2013). Zimmermann (2010) argues that linear functions are the most basic and practical approximation to model human language (non-linear functions are also possible; e.g., Dhingra, Rao, & Kumar, 1992). Such fuzzy linear functions can be defined by fixing two points, that is, the lower and upper aspiration levels that humans want to achieve (Zimmermann, 2010). Transferring this fuzzy set theory logic to the Handprint, the evaluation approach assigns a grade of membership between zero and one on a linear function between a lower aspiration level (i.e., no contribution to the SDGs = Zero) and an upper aspiration level (i.e., contributions to the SDGs = One) to each selected indicator.

Figure 13 illustrates the evaluation approach by defining an exemplary linear fuzzy set function that expresses the relation between the selected indicator of low-income wages and the SDG 1.1 (“By 2030, eradicate extreme poverty for all people everywhere, currently measured as people living on less than \$1.25 a day”; UN, 2015). This illustrative exemplary linear function is based on the judgments of the project team after several iterative rounds of discussion with external stakeholders. We argue that the function is set between the lowest aspiration level (Zero; where the daily average wages paid to workers of the lowest income category just reach the national minimum wage per day, if it is above the bare minimum of 1.25 US Dollar per day set by the UN) and the upper aspiration level (One; where the daily average wage paid to workers of the lowest income category reaches or exceeds the regional living wage). Thus, this fuzzy set function illustrates contributions to SDG 1.1. Further fuzzy set functions are currently under development and being tested in the case studies.

Figure 13. Illustration of the evaluation phase of the Handprint approach based on an exemplary linear fuzzy function



6.4.2. Critical evaluation of the Handprint approach

The objective of the Handprint approach is to provide a suitable approach to assess positive contributions to the SDGs. The approach provides a number of opportunities. For example, the Handprint approach can support supply chain risk management by identifying and protecting important stakeholder benefits to prevent reputation damages or losing the social license to operate. Moreover, the orientation toward positive sustainability contributions offers a vision toward a sustainability transformation of business and society.

However, the Handprint also has certain limitations. The approach is complex in terms of data collection and evaluation. The different types of data require expertise of the assessor to gather quantitative and qualitative data from different areas, such as environmental, social, health, economic, and governance aspects. Data collection is especially challenging and time intensive, as current databases often include a wide range of environmental data but lack social data. Furthermore, data need to be compiled from sources across the whole supply chain because the Handprint approach builds on life cycle thinking.

The aim of positive contributions to the SDGs along product life cycles and corporate supply chains has so far received little attention. The Handprint incorporates the SDGs as an orientation for sustainability assessment. While this orientation can be helpful, some aspects, such as animal welfare, are not (yet) covered. Therefore, the orientation towards the SDGs also leads to neglecting areas and indicators that belong to sustainable development and might be relevant for sustainability assessment. The application in practice will contribute to a detailed and refined set of indicators. The aim of achieving practicability represents a certain trade-off to the scientific preciseness of the results, which is a typical issue in life cycle assessment approaches (Freidberg, 2015). Therefore, the Handprint requires further testing and application in practice. The next phase of the projects aims at conducting case studies to improve and fine-tune the approach. Throughout the case studies, the indicators will be tested and potentially reduced or complemented. Testing and further research on the different phases of the Handprint approach represent important avenues for future research.

6.5. Conclusion

This paper presents an overview of the current research state of evaluating positive contributions to the SDGs along with first empirical findings, while the testing in case studies was ongoing at the time of writing this article. The Handprint is a unique sustainability assessment approach in terms of several key areas. First, the development involved a broad range of experts from academia, business practice, and stakeholders from civil society in iterative rounds of discussion and refinement. Second, the Handprint is an empirically based assessment approach that strives for a balance between scientific comprehensiveness and practicability. Third, to achieve this shift, we particularly operationalize how businesses and products contribute to achieving the SDGs by incorporating fuzzy set theory into the evaluation step of the Handprint approach. Thus, the Handprint aims at shifting the focus from reducing

unsustainable, negative business practices toward positive contributions to sustainable development in sustainability assessment and management.

7. Overarching discussion and conclusion

In this dissertation, I present two systematic literature reviews and three empirical studies to advance the balance, completeness, and general understanding of social and positive sustainability performance measurement. In the following, I synthesize the key findings and contributions of the studies presented in the dissertation, before complementing this discussion with insights from a systematic review of practice cases of sustainability performance measurement approaches. Thus, I contribute to understanding which indicators are deemed useful in business practice and how firms implement social and positive sustainability performance measurement, which are critical shortcomings in extant research (e.g., Bourne et al., 2000; Searcy, 2012). Finally, I discuss implications for research and practice, before concluding my dissertation.

From a methodological perspective, a major contribution of this dissertation lies in the foundation on the multitude of research methods employed (especially, systematic reviews of research and corporate practice, an extensive Delphi study, and qualitative interviews) and the resulting richness of multiple empirical data sets. Such a broad foundation on empirical experience is pivotal for the development, establishment, and standardization of sustainability assessment approaches (Baumann et al., 2013). Therefore, the broad empirical foundation of this dissertation contributes to the development of general standardized measures of social and positive sustainability performance. Furthermore, a key function of empirical studies is generating data used for theorization (Van Maanen et al., 2007) because the empirical nourishes the emergence of theories (Touboullic & Walker, 2015). Therefore, the multitude of empirical

data generated and used in this dissertation allows for various theoretical reflections and contributions.

7.1. Theory contributions

This dissertation makes multiple major contributions to several theories in management and organizational research. The first study (chapter two) contributes to theory, by reviewing the use of various theories (i.e., systems theory, stakeholder theory, resource based view of the firm, network theory, institutional theory, resource dependence theory, transaction cost theory, and governmentality theory) in the field and elaborating the overall purpose of each theory in terms of social performance measurement. The first study concludes that theory-building efforts in social performance measurement research are scarce so that the field is largely a-theoretical.

Because much research on social performance measurement is resting on a fragile theoretical base, the second study (chapter three) explicitly takes an open systems theory perspective (e.g., Mitnick, 2000; Williams et al., 2017) to strengthen the use of theories in the field. The second study argues that extant research lacks a systemic orientation in social performance measurement and proposes determinants explaining this shortcoming. Based on these propositions, the second paper provides a conceptual framework as a guide to future research. The framework adopts a systemic perspective for a holistic evaluation of social performance and explains how the interrelation of determinants in business organizations, supply chains, and the external system environment influences the (lacking) comprehensiveness when assessing social performance along product life cycles and supply chains. Thus, my systemic framework helps to determine which social issues to measure and counters the weakness of existing frameworks of being more descriptive than analytic (Whitehead, 2017). Consequently, the value of the systemic framework in the second study lies in triggering a shift from primarily

descriptive research toward theory development and consolidation (Touboulic & Walker, 2015) in social performance measurement research.

The third study (chapter four) bridges the discussion from social performance measurement to positive sustainability performance measurement by investigating the interrelated core challenges and opportunities of both inherently connected fields in the light of organizational functional effectiveness theory (e.g., Cunningham, 1977; Kroeger & Weber, 2015). Specifically, the third study discusses whether and how the challenges and opportunities of social and positive sustainability performance measurement act as barriers and drivers that influence functional effectiveness of organizations and product systems. Thus, the study contributes the establishment of a theoretical foundation for positive PSPM research, which is lacking a clear conceptualization of the characteristics that constitute PSP.

To overcome this fundamental obstacle in the development of PSPM, the fourth study (chapter five) uses practice theory (e.g., Gram-Hanssen, 2010; Reckwitz, 2002; Schatzki, 1997) to establish a universal understanding of the constituents and characteristics of PSP and, thus, builds the conceptual foundation for its future measurement and management. In the light of practice theory, the fourth study identifies and prioritizes a set of characteristics that constitute PSP and synthesizes an empirical qualitative framework. Thus, the study provides a first step toward a universal understanding of how industrial production and consumption contribute to sustainable development. Furthermore, it establishes a foundation for the future development of indicators assessing sustainable business practices that go beyond merely counteracting negative business outcomes toward actually delivering sustainability benefits for business and society.

To develop such a concrete PSPM approach, the fifth study presents the methodological development the “Handprint” research project that aims at developing and testing a sustainability assessment approach to evaluate positive contributions to the UN Sustainable

Development Goals (SDGs) at product level. The fifth study incorporates fuzzy set theory (e.g., Zadeh, 1965; Zimmermann, 2010) to address and evaluate the verbal fuzziness of the SDGs for business organizations and their products. Thus, the fifth study operationalizes how businesses and products contribute to achieving the SDGs.

From an applied measurement perspective, the first and second studies contribute to a more coherent understanding of social performance in research and practice by synthesizing two minimum sets of the most important social indicators typically used in research. This is worthwhile, because a certain consensus is a precondition for establishing a standard set of social indicators. Furthermore, these studies highlight typical measurement approaches and the rationale for the inclusion of these social indicators. Additionally, the studies contribute by emphasizing critical challenges in applying these indicators and by providing recommendations for their future development. Moreover, the fifth study complements the discussion on social indicators by providing an empirically based indicator system that operationalizes and evaluates positive contributions to sustainable development at product level.

However, beyond the scientific contributions (i.e., the broad foundation on various research methods and multiple rich empirical data sets, various contributions to theory development, and an advanced understanding of measuring social and positive sustainability performance), a final key research question remains in terms of the actual implementation and use of social and positive sustainability performance measurement in business practice (e.g., Beske-Janssen et al., 2015; Bourne et al., 2000; Searcy, 2012): How do companies perceive the relevance of social and positive sustainability performance measurement and what indicators do they perceive as particularly useful in decision making? In the following, I address this critical research question to complete my dissertation.

7.2. Complementing contributions of the dissertation with insights from a systematic review of corporate practice

In the first paper (chapter two), I realized that the practical implementation of social and positive sustainability performance measurement has largely been neglected in research. Also, Beske-Janssen et al. (2015) argue that it is startling that sustainability performance measurement approaches developed and used in business practice have not been subject to scientific investigation. Therefore, studying such initiatives from business practice would provide a better understanding of how companies perceive the relevance and usefulness of social and positive sustainability indicators in decision making (Searcy, 2012) which would also contribute to the future development of measurement approaches in research (Beske-Janssen et al., 2015).

Therefore, to complement the scientific discussion of this dissertation, I provide a systematic review of practice cases of sustainability performance measurement approaches. To achieve this aim, I transfer the systematic literature review approach suggested by Denyer and Tranfield (2009) to a systematic review of corporate practice. Thus, I aim at revealing trends, relationships, inconsistencies, and gaps in business practice in order to organize, evaluate, and synthesize what is (un)known (Crossan & Apaydin, 2010) in the business practice of social and positive sustainability performance measurement.

To locate cases from corporate practice, I identified companies listed on the Standard & Poor's 500 (S&P 500) and the Stoxx Europe 600 (STXE 600) indices (as of January 30th, 2015). I argue that companies listed on two significant share indices are more likely (compared to smaller companies) to bear the costs associated with the establishment of a sustainability performance measurement approach. The potential differences in sustainability management and performance measurement between rather shareholder-oriented Anglo-American companies and rather stakeholder-oriented Continental European companies (Matten & Moon,

2008) should contribute to the data quality. To explore business practice in certain scientific fields, Bocken et al. (2014) propose to conduct a review of practice examples based on grey literature. Consequently, a Google search was conducted that combined the different company names with the keywords “sustainability measurement,” “sustainability assessment,” and “sustainability analysis” to identify grey literature (especially, company presentations, workings papers, internet blogs, or website information; Appendix VI provides an overview of the references investigated in the systematic practice review) on the development and implementation of corporate performance measurement approaches that explicitly integrate indicators from all three sustainability dimensions. Only proprietarily developed practice approach that explicitly integrate social indicators (besides ecological and economic indicators) for the purpose of internal decision-making (not external reporting) were selected for the further analysis. Table 23 provides an overview of the resulting 22 companies that clearly claim to develop and use proprietary sustainability performance measurement approaches.

Table 23. Identified corporate sustainability performance measurement approaches integrating social, economic, and ecological indicators

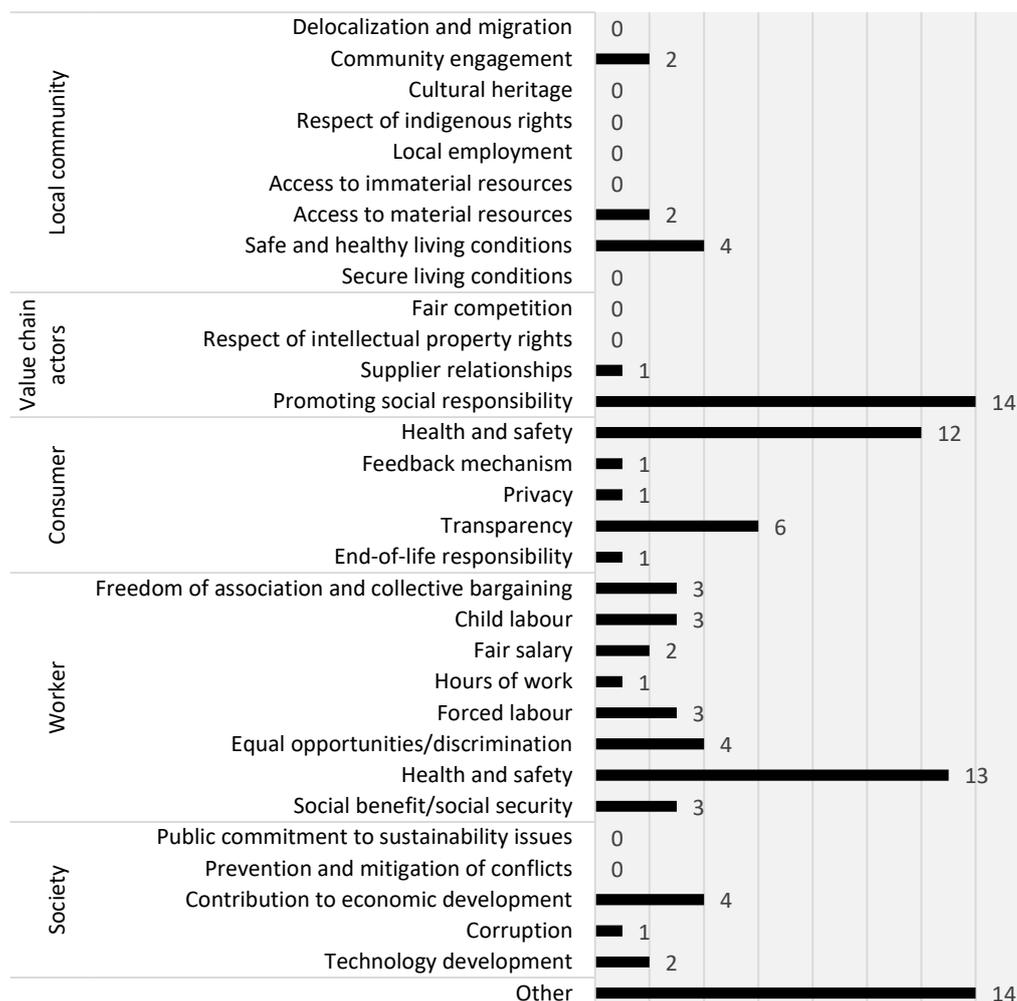
Company name and designation of sustainability performance measurement approach	North American Industry Classification System (NAICS)	Identification via share indices	Sources (see Appendix VI for references)
3M Company – Life Cycle Matrix	Miscellaneous manufacturing	S&P 500	Price and Coy (2001); Toyne (2005)
Clorox Company – Preferred Ingredient Calculator	Chemical manufacturing	S&P 500	Clorox Company (2014a, 2014b, 2015a, 2015b)
Colgate-Palmolive – Product Sustainability Scorecard	Chemical manufacturing	S&P 500	Colgate-Palmolive Company (2015)
Delphi Automotive – Manufacturing Capability Assessment	Transportation equipment manufacturing	S&P 500	Delphi Automotive (2008, 2013, 2015)
Dow Chemical – Sustainability Footprint Tool	Chemical manufacturing	S&P 500	Russell (2011, 2012), Russell and Shiang (2012)
Food Machinery Corporation (FMC) – Sustainability Assessment Tool	Chemical manufacturing	S&P 500	FMC Corporation (2013)
Ford – Product Sustainability Index	Transportation equipment manufacturing	S&P 500	Ford (2007); Schmidt (2007); Singh, Murty, Gupta, and Dikshit (2009)
Johnson & Johnson – Earthwards	Chemical manufacturing	S&P 500	Johnson & Johnson (2015a, 2015b, 2015c), Sutter (2013)
Marriott International – Supplier Sustainability Assessment Program (MSAP)	Accommodation	S&P 500	Marriott International (2015a, 2015b)
Procter & Gamble – Product Sustainability Assessment Tool	Chemical manufacturing	S&P 500	Franke (2005); UNEP (2006)
Starbucks Coffee Company – Coffee and Farmer Equity (C.A.F.E.) Scorecard	Food manufacturing	S&P 500	Starbucks Coffee Company (2014); Thomas, Baer, Semroc, and Sonenshine (2014)
Target Corporation – Sustainable Product Standard	General merchandise stores	S&P 500	Target Corporation (2013a, 2013b)
Wal-Mart – Sustainability Index	General merchandise stores	S&P 500	Wal-Mart (2009a, 2009b, 2010, 2015)
Alcatel-Lucent – Sustainability Impact Analysis	Telecommunications	STXE 600	Alcatel-Lucent (2015a, 2015b)
BASF – SEEBalance	Chemical manufacturing	STXE 600	Müller and Saling (2011); Schmidt et al. (2004)
Bayer – Sustainability Check	Chemical manufacturing	STXE 600	Bayer (2011); Kurunsaari, Roevekamp, and Okano (2003)
Berkeley Group – Social Sustainability Framework	Construction of buildings	STXE 600	Berkeley Group (2012)
Deutsche Telekom – Sustainability Compass	Telecommunications	STXE 600	Otto (2005)
Henkel – Sustainability Master	Chemical manufacturing	STXE 600	Henkel (2013, 2015a, 2015b)
SABMiller – Sustainability Assessment Matrix	Beverage and tobacco product manufacturing	STXE 600	SABMiller (2015a, 2015b)
Solvay – Sustainable Portfolio Management	Chemical manufacturing	STXE 600	Solvay (2014, 2015a, 2015b)
Unilever – Brand Imprint	Chemical manufacturing	STXE 600	Unilever (2009); World Business Council for Sustainable Development (2010)

The next step was to analyze the data material from business practice with a deductive approach. Deduction requires choosing *ex ante* an existing theoretical or conceptual framework as a lens for analyzing the data to arrive at a plausible generalization of findings (Seuring & Gold, 2012; Timmermans & Tavory, 2012). Employing this deductive logic in this research, I chose the subcategories developed for the SLCA guidelines (UNEP & SETAC, 2013) as the first analytical lens since they are considered the “landmark in the field” (Corona et al., 2017, p. 2). Consequently, I assigned the indicators used in the practice examples to the SLCA subcategories. Furthermore, I chose the PSP characteristics of the PSPM framework from the fourth study (see again Figure 9 in chapter five of the dissertation) as the second analytical lens since they represent a first step toward a universal understanding of how industrial production and consumption contribute to sustainable development. By investigating how frequently the practice cases address the SLCA subcategories and PSP characteristics, I evaluate the relevance of the subcategories and characteristics in business practice. This allows for juxtaposing and analyzing the indicators used in business practice and research. Thus, I reveal consistencies, divergences, and shortcomings in the use of indicators between business practice and research.

7.2.1. Discussing social performance measurement in business practice

Most practice cases are from the manufacturing sector, which is similar to the academic focus on the manufacturing sector in social performance measurement research (as elaborated in the first study in chapter two). However, from a stakeholder salience perspective (Mitchell et al., 1997), business practice is characterized by notable deviations from research. In research, workers are the most salient stakeholder group, followed by local communities and society with a moderate salience, whereas consumers and value chain actors are the least salient and often neglected stakeholder groups. To illustrate how business practice deviates from research, Figure 14 provides a detailed picture of the number practice cases addressing a SLCA subcategory per stakeholder group.

Figure 14. Overall distribution of practice approaches addressing a subcategory per stakeholder group from the methodological sheets for SLCA (UNEP & SETAC, 2013)



Note: A single practice approach may address multiple subcategories per stakeholder group so that the numbers do not add up to the total number of practice approaches. SLCA = social life cycle assessment.

Consistent with research, business practice heavily emphasizes the salience and importance of assessing health and safety impacts on workers. However, diverging from research, business practice also stresses the importance of assessing health and safety at suppliers (as part of promoting social responsibility among value chain actors) and health impacts on consumers. Therefore, unlike research, which is often criticized for neglecting social impacts on multiple stakeholders (e.g., Gualandris et al., 2015), business practice is less likely to run the same risk, at least in terms of health impacts. The practice cases neglect assessing impacts on local communities and general society as least salient stakeholder groups in business practice,

whereas these stakeholder groups have a moderate salience in research. Again, the practice cases emphasize indicators of safe and healthy living conditions in local communities, whereas impacts on society are assessed with indicators of job creation to capture firms' contribution to society's economic development.

Similar to research, the majority of the practice examples use indicators that address categories other than those from the SLCA guidelines and methodological sheets. These other categories especially emphasize the importance of product features (e.g., functional performance of products, quality of product ingredients, and product affordability and availability) and to a lesser extent compliance with regulation. The focus on assessing compliance with regulation in business practice is noteworthy because it contradicts Mitnick's (2000) proposition that firms prefer to assess adherence to voluntary initiatives, ethics policies, or codes of conduct, because they are relatively inexpensive and unrestrictive. Only US-American firms in the sample explicitly integrate legal compliance into their sustainability performance measurement approaches. European companies seem to act in compliance with the law more implicitly and do not articulate it for performance measurement purposes. The decision to explicitly integrate or implicitly enact (Matten & Moon, 2008) the assessment of regulatory compliance points to institutional processes (DiMaggio & Powell, 1983) that determine the development and implementation of sustainability assessment approaches in business practice. Differences in the institutional environment between European and US-American business systems seem to be a determining factor. Taking into account the emphasis on adhering to coercive institutions (i.e., regulation), I argue that corporate practice primarily integrates the "must-haves" of legal compliance into sustainability performance measurement to adapt to the surrounding institutional environment.

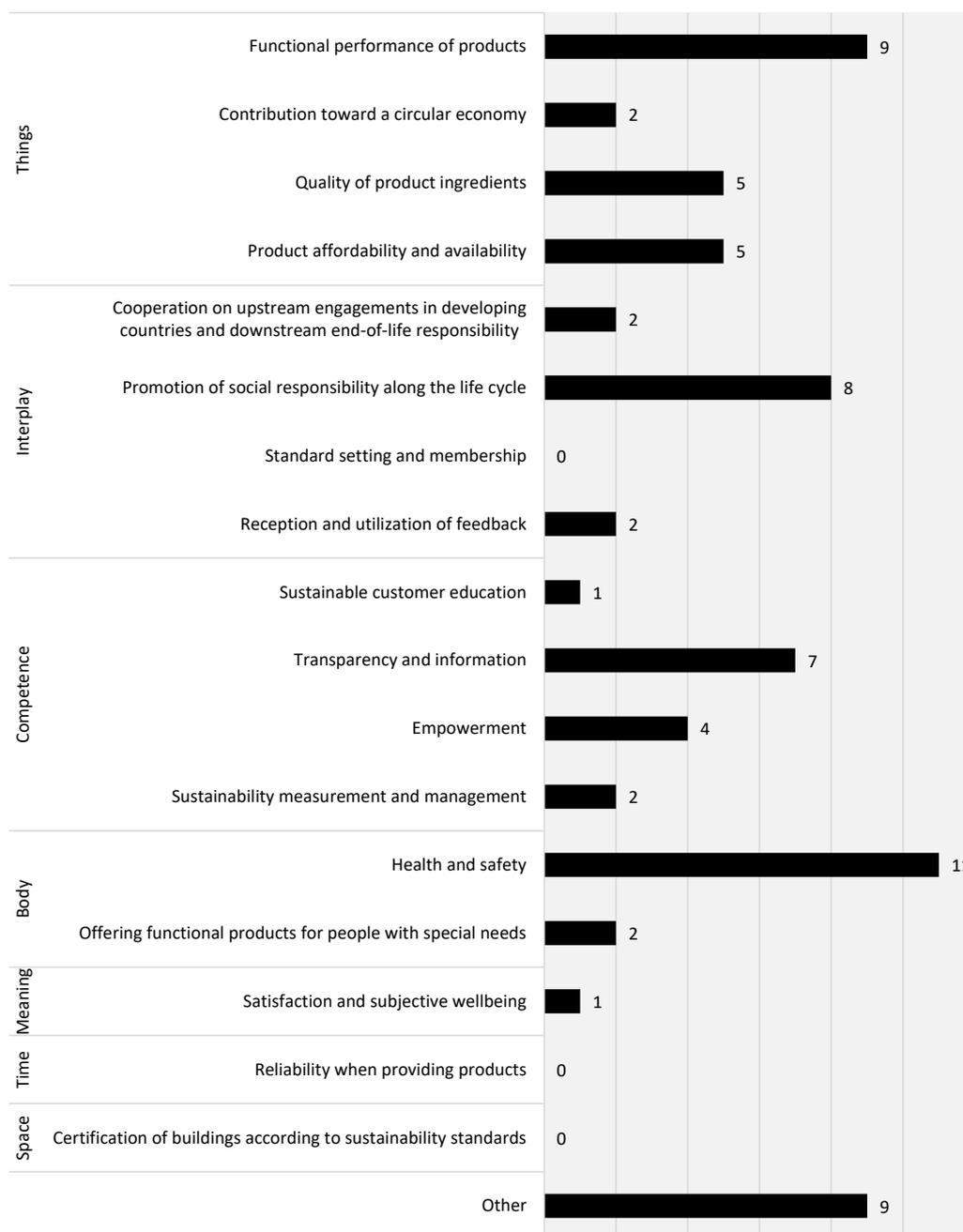
This is a shortcoming, given that firms' institutional environments are dynamic and involve more than just regulatory expectations and requirements such as mimetic (e.g., adherence to

voluntary social standards by peers), normative (e.g., professionalization in implementing sustainability management and monitoring systems), and other coercive institutions (e.g., cultural expectations; DiMaggio & Powell, 1983) beyond regulatory pressures. For instance, the influence and inclusion of culture and cultural values are scarcely found in existing research (Pizzirani et al., 2014) and business practice. Only the Procter & Gamble–Product Sustainability Assessment Tool generically claims to assess how their products challenge cultural norms (Franke, 2005). A more intensive integration of culture in social performance measurement research and business practice would be valuable because cultural aspects can serve as a reference line to conceive and characterize what is socially damaging or beneficial (Pizzirani et al., 2014).

7.2.2. Discussing positive sustainability performance measurement in business practice

Overall, business practice claims to assess sustainability benefits and contributions to sustainable development at the product level. In particular, the practice cases emphasize the importance of assessing products' health and safety benefits, and products' functional utility to help product users meeting their needs. Furthermore, the practice cases stress the assessment of how companies promote social responsibility along the product life cycle. Figure 15 provides a detailed picture of the number of practice cases addressing a PSP characteristic per practice theory element (Reckwitz, 2002) from my framework of PSP measurement (for the framework, see again Figure 9 in the fourth study in chapter five of the dissertation; for a detailed overview of the specific indicators used in business practice see again Table 20 in the fifth study in chapter six).

Figure 15. Overall distribution of practice approaches addressing a PSP characteristic per practice theory element (Reckwitz, 2002) from the framework of PSP measurement (see again Figure 9 the fourth study in chapter five of the dissertation)



Note: A single practice approach may address multiple PSP characteristics per practice theory element so that the numbers do not add up to the total number of practice approaches. PSP = positive sustainability performance.

The majority of business practice examples claims to integrate positive benefits aspects into sustainability performance measurement. Although the validity of the specific indicators used can be questioned (e.g., a product’s “potential to address world challenges” in the Dow

Chemical–Sustainability Footprint Tool; Russell, 2011), this points to the increasing importance of PSPM in business practice. Overall, the identified practice cases appear to be more eager than academia in terms of exploring PSPM. However, the indicators used in business practice are often overly generic so that it is hardly possible to investigate whether the indicators are based on qualitative elaborations or quantitative metrics. Furthermore, the initiatives from business practice are facing similar problems and challenges compared to research. There are inconsistencies in the selection of indicators because firms and their stakeholders can have differing experiences and perceptions in terms of the relevance of social and positive sustainability impacts to be assessed, which indicators are suitable, and which data are available and usable. Furthermore, the practice cases lack a common understanding of positive sustainability performance. For example, some practice cases provide indicator systems to understand their sustainability performance, whereas other practice examples aim at aggregating positive and negative sustainability performance into a single index. However, aggregation might lead to misinterpretation because positive and negative sustainability performance are distinct constructs (e.g., Delmas et al., 2013; Mattingly & Berman, 2006; Strike et al., 2006). Moreover, many of the practice cases claim to allow for a quantification of positive sustainable value creation. The emphasis on quantification might compromise the completeness of performance measurement because some positive (especially, social) sustainability impacts are often of a qualitative nature and not easily quantifiable. Additionally, the validity and reliability of the practice cases can be questioned, because most of these initiatives hardly provide enough publicly available information for a definitive evaluation of the stage of development, actual implementation, or evolution (Bourne et al., 2000) of their (positive) sustainability performance measurement approaches. This inaccessibility of data is a typical problem in social and sustainability performance measurement research because some companies have good reasons for being non-transparent, whereas others might even be

manipulative when providing publicly available information to signal their honest (or sometimes deceptive) efforts of measuring and managing positive contributions to sustainable development (Wood, 2010).

Overall, only a minority of companies (22 out of 1100 companies from the S&P 500 and STXE 600) provided publicly available data on the development and implementation of their proprietary sustainability performance measurement approaches. The approaches and indicators suggested are characterized by a high level of variation, because there is no established standard that clearly guides the development and implementation of an integrated sustainability performance measurement. Consequently, overall business practice seems to marginalize social and positive sustainability performance measurement. However, this systematic review of corporate practice also shows that there are a few promising frontrunners that realized the importance and opportunities of measuring and managing social and positive sustainability performance.

7.3. Implications for research and practice

In the following, I provide an overarching synthezation of implications for research and practice derived from the dissertation as a whole. The implications are organized along the key phases of design, implementation, and evolution through which performance measurement approaches typically progress in their development and maturation (Bourne et al., 2000; Searcy, 2012). Thus, I provide avenues and recommendations for future research and practice.

The design phase of performance measurement approaches deals with the identification of key social aspects to be considered and the development of adequate corresponding indicators (Bourne et al., 2000). The majority of efforts in research aim at designing social and positive sustainability performance measurement approaches and related indicators. However, the indicators are largely based on common sense (sometimes even without any further

justification) instead of empirical experience or theoretically based reflections. Consequently, researchers use various inconsistent indicators that they subjectively believe are most important and, thus, find contradicting results. Therefore, the field has not yet arrived at a valid and consensual understanding of social performance as well as positive sustainability performance. As a result, the development of social performance measurement is lagging behind environmental and economic measurement which impedes efforts of integrating social, ecological, and economic indicators holistically (Hoogmartens et al., 2014). An implication to overcome this lagging development is that research and business practice first need to establish a simultaneous (but separate) understanding of positive and negative social, ecological, and economic measures before achieving a truly holistic sustainability integration in the long-term. Therefore, the tendency of aggregating performance measures into (ostensibly holistic) sustainability indices might lead to misinterpretations because positive and negative social, ecological, and economic performance are distinct constructs (e.g., Mattingly & Berman, 2006; Strike et al., 2006; Wood, 2010). An implication for business practice is to develop and use systematic indicator systems that simultaneously and separately display individual sustainability indicators. Thus, managers have a transparent and comprehensible foundation to decide which levers to pull for delivering sustainability benefits for business and society.

The implementation and use phase addresses the procedures put in place to regularly collect and process data to support decision-making and derive recommendations for action (Bourne et al., 2000). Little is known about the implementation and use of sustainability in business practice. Therefore, various questions remain, for example, regarding the factors that determine the success and failure of performance measurement approaches in business practice, the costs of implementation, issues of data availability, data collection, and data processing, the relationship between (negative and positive) sustainability performance measurement and actual sustainability performance, differences between industry sectors, or the identification of

indicators deemed as particularly useful in business practice (Searcy, 2012). At least in terms of the last two topics (i.e., sector differences, and particularly useful indicators), the systematic practice review (presented above in this chapter) provides first insights to address these remaining critical research avenues. Specifically, the practice review demonstrates the dominance of the manufacturing sector in developing and implementing sustainability performance measurement approaches. Furthermore, the practice review revealed the importance and practical usefulness of assessing indicators related to health and safety, the promotion of social responsibility, and products' functional utility to help product users meeting their needs. However, the practice review also emphasizes that social and positive sustainability performance measurement are not (yet) very relevant and popular decision supporting instruments in business practice, mainly due to the complexity of sustainability assessment. In academia, there is a tendency to broaden and deepen sustainability assessment approaches which, thus, become increasingly complex and difficult for practitioners to use (Croes & Vermeulen, 2015). Therefore, the studies presented in this dissertation also provided decision-makers with practical yet scientifically robust indicators to measure and assess social performance and PSP. Testing and validating the long-term usefulness of these indicators in business practice is another implication for research, which would also trigger a more intensive engagement of research with business practice.

The evolution phase puts the focus to the feedback and learning processes which includes changing, replacing, and deleting indicators (Bourne et al., 2000). This dissertation revealed that research on the evolution and adaption of sustainability performance measurement is scarce and almost completely absent in the field. This is a critical shortcoming, since regular evaluations support and test the continuous validity and usefulness of sustainability performance measurement approaches. Furthermore, a stronger focus on the evolution phase might provide insights regarding the influence of social and positive sustainability performance

measurement on triggering a shift from short-term profit thinking to long-term progress of social responsibility and sustainable development in business practice (Bourne et al., 2000). Again, such (longitudinal) research implies a stronger research focus on actual business practice. For example, future research could repeat the practice review approach suggested above. Thus, future researchers could investigate whether business practice adds or removes certain indicators over time, what factors drive or impede such adaptations over time, or how such adaptations contribute to the positive improvement of sustainability performance.

7.4. Conclusion

This dissertation contributes to a more balanced and complete understanding of social and positive sustainability performance. Based on a broad foundation on multiple empirical data sets, this dissertation contributes to the development of conceptual frameworks and general standardized measures of social and positive sustainability performance. Thus, it allows for various theoretical reflections and contributions. Furthermore, the individual studies presented in this dissertation offer valuable findings for research and managerial practice in the field. Together, the five studies highlight the trends, coherences, inconsistencies, and gaps in social and positive sustainability performance measurement. Furthermore, the studies establish and explain the interrelation between social and positive sustainability performance measurement, advance their conceptual and theoretical foundation, promote standardization by prioritizing relevant indicators, and suggest an approach to measure and evaluate positive contributions to sustainable development. Overall, this dissertation provides an important step to measure and ultimately manage social and positive sustainability performance. Thus, it establishes a foundation for the development of sustainable business practices that go beyond merely counteracting negative business outcomes toward actually delivering positive sustainability benefits for business and society.

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Appendix I: Search strings and rationale of the systematic literature review approach

Search Strings and Rationale	Results in	
	SSCI	EBSCO
1st search string: TI=((soci* OR sustainab* OR integrat* OR responsib* OR CSR OR TBL OR “triple bottom line”) AND “life cycle”) AND TS=(soci* AND (assess* OR analy* OR account* OR quanti* OR indicator* OR index OR indices OR measur* OR metric* OR criteria))	70	42
Combination of the alternative anchor keywords soci*, sustainab*, integrat*, responsib*, CSR, TBL, or “triple bottom line” in the title search together with the anchor keyword soci* in the topic search as fixed basis for all search strings. Thus, the identified articles always addressed the social dimension of sustainability, since an abundance of papers on sustainability often exclusively deal with ecological or economic concerns. We complemented the anchor title search with “life cycle” while simultaneously combining the anchor topic search with keywords targeting performance measurement (e.g., assess*) in order to locate articles dealing with social indicators or performance measures from a life cycle and industrial ecology perspective.		
2nd search string: TI=((soci* OR sustainab* OR integrat* OR responsib* OR CSR OR TBL OR “triple bottom line”) AND (assess* OR analy* OR account* OR quanti* OR indicator* OR index OR indices OR measur* OR metric* OR criteria)) AND TS=(soci* AND “life cycle”)	123	58
Complementary keyword “life cycle” now in the topic search instead of the title search and the performance measurement keywords (e.g., assess*) now in the title search instead of the topic search to avoid missing any relevant articles.		
3rd search string: TI=((soci* OR sustainab* OR integrat* OR responsib* OR CSR OR TBL OR “triple bottom line”) AND “supply chain”) AND TS=(soci* AND (assess* OR analy* OR account* OR quanti* OR indicator* OR index OR indices OR measur* OR metric* OR criteria))	101	172
Repeats the first search run replacing the complementary keyword “life cycle” with “supply chain” for a broader coverage of relevant articles.		
4th search string: TI=((soci* OR sustainab* OR integrat* OR responsib* OR CSR OR TBL OR “triple bottom line”) AND (assess* OR analy* OR account* OR quanti* OR indicator* OR index OR indices OR measur* OR metric* OR criteria)) AND TS=(soci* AND “supply chain”)	81	62
Repeats the second search run replacing “life cycle” with “supply chain” in the fourth and final search string for broader coverage or relevant article.		
Number of papers (excluding duplicates)		467
Number of papers with substantial relevance for this literature review after screening		141

Note. In the SSCI database, the search strings can be entered directly via advanced search, whereas the EBSCO database uses an entry mask requiring to manually select search fields. In both databases the title search field (TI) is equivalent. But in SSCI, the topic search (TS) encompasses titles, abstracts, and keywords, whereas EBSCO is confined to an abstract-only search field (AB), instead of a topic search.

Appendix II: Joint sample of 141 articles included in the systematic literature reviews presented in the first and second study (chapters two and three)

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Appendix III: Panel characteristics after the final round of the Delphi study (presented in chapter four)

Experts	Expert group	Organization (Country)	Description of expertise	Participation in inquiries
1	Academic	University (France)	Professor of decision and information sciences for production systems	SLCA
2	Academic	University (U.S.)	Senior research associate in a sustainable products initiative	SLCA
3	Academic	University (Italy)	Professor of food science, animal science, and aquaculture	SLCA
4	Academic	University (Canada)	Associate professor of sustainability measurement, management, and reporting	SLCA
5	Academic	University (U.K.)	Senior research associate in the field of public and civil society engagement, and perceptions of energy, technology, and policy	SLCA
6	Academic	University (South Africa)	Professor of sustainable development and technology management practices	PSPM
7	Academic	University (China)	Associate professor of architectural and civil engineering	PSPM
8	Academic	University (Canada)	Professor of operations management	PSPM
9	Academic	University (U.S.)	Associate professor of architectural engineering	PSPM
10	Academic	University (Italy)	Professor of industrial engineering	PSPM
11	Academic	University (Denmark)	Researcher in the field of management engineering	SLCA & PSPM
12	Academic	University (Sweden)	Assistant professor of environmental systems analysis	SLCA & PSPM
13	Academic	Business school (France)	Professor of sustainable development, marketing, and strategic management	SLCA & PSPM
14	Academic	University (Thailand)	Professor of environmental engineering	SLCA & PSPM
15	Academic	University (Switzerland)	Professor of informatics and sustainability	SLCA & PSPM
16	Academic	University (Sweden)	Senior lecturer in the field of engineering and quality sciences	SLCA & PSPM
17	Academic	University (Germany)	Professor of engineering, energy, and information	SLCA & PSPM
18	Academic	Research institute for rural areas, forestry, and fishery (Germany)	Researcher in the field of resource efficiency and life cycle assessment	SLCA & PSPM
19	Academic	University (Norway)	Researcher in the field of socio-economic metabolism and socio-economic drivers for environmental impacts	SLCA & PSPM
20	Academic	University (Australia)	Associate professor of operations and supply chain management	SLCA & PSPM
21	Academic	University (Italy)	Associate professor of industrial engineering	SLCA & PSPM
22	Academic	University (Belgium)	Professor of environmental economics	SLCA & PSPM
23	Academic	University (Germany)	Professor of life cycle assessment and sustainability management	SLCA & PSPM

Appendix III: Continued

24	Business	Enterprise software company (Germany)	Chief expert und senior consultant for social sustainability und human resources	SLCA
25	Business	Food and beverage company (Germany)	Project manager for responsible sourcing	SLCA
26	Business	Retail company (Germany)	Project leader for corporate social responsibility	SLCA
27	Business	Sustainability rating agency (Germany)	Senior analyst	SLCA
28	Business	Software and consulting company (Germany)	Life cycle assessment software expert	PSPM
29	Business	Chemical company (Germany)	Director of sustainability analysis methods	PSPM
30	Business	Cosmetics company (Germany)	Head of corporate sustainability	PSPM
31	Business	Social impact management consultancy (Netherlands)	Director with experience in development economics, business ethics, and business administration	SLCA & PSPM
32	Business	Automotive company (Germany)	Head of corporate sustainability	SLCA & PSPM
33	Other	Regional church (Germany)	Project leader for socio-ecological sourcing	PSPM
34	Other	Municipal waste water treatment (Germany)	Project leader for waste water	PSPM
35	Other	Certification organization (Germany)	Product manager for ecological product certification	SLCA & PSPM
36	Other	Foundation for sustainable quality of life (Switzerland)	President of the foundation	SLCA & PSPM

**Appendix IV: Delphi participants' ratings of challenges of SLCA and PSPM
during the second and third Delphi rounds (presented in chapter four)**

Challenges of SLCA			Challenges of PSPM		
Items aggregated in R1	R2: MV (SD) on five-point-scale	R3: MV (SD) on nine-point-scale	Items aggregated in R1	R2: MV (SD) on seven-point-scale	R3: MV (SD) on nine-point-scale
Complexity of social and cultural issues	3.72 (1.05)	6.96 (1.93)	Assessing positive benefits requires long-term thinking	5.81 (1.12)	7.08 (2.50)
Limited availability of data	3.83 (1.11)	6.67 (2.30)	Reaching consensus on what constitutes a positive benefit	5.65 (1.06)	6.80 (2.30)
Complexity of supply chains	3.65 (1.20)	5.78 (1.91)	Problems of data collection about positive benefits	5.53 (1.36)	6.16 (1.80)
Lack of management commitment	3.60 (1.22)	5.56 (2.17)	Treatment of trade-offs (offset) between positive and negative impacts	5.45 (1.34)	5.96 (1.37)
Limited market incentives	3.53 (1.17)	5.52 (2.08)	Setting a universal benchmark to evaluate what is positive or negative	5.35 (1.45)	5.36 (1.83)
Lack of consensus on social indicators	3.56 (1.08)	5.33 (1.69)	Uncertainty how one product may positively/negatively influence another product	5.10 (1.44)	4.72 (1.61)
Costs of social assessments	3.21 (1.10)	4.48 (1.72)	Differing development stages of assessment methodologies between the three sustainability dimensions	5.10 (1.25)	4.28 (1.54)
Lack of technical know-how of social assessment methods	3.44 (1.11)	4.48 (1.76)	Changing the current established perspective from reducing negative issues to generating positive benefits	5.00 (1.53)	3.44 (2.12)
Time requirement of social assessments	3.32 (1.05)	4.41 (2.04)			
Limited regulation	3.25 (1.39)	4.11 (1.93)			

Note. Items are prioritized by the mean values (MV) and standard deviations (SD) of ratings from the third and final round (R) in descending order.

Appendix V: Delphi participants' ratings of opportunities of SLCA and PSPM during the second and third Delphi rounds (presented in chapter four)

Opportunities of SLCA			Opportunities of PSPM		
Items aggregated in R1	R2: MV (SD) on five-point-scale	R3: MV (SD) on nine-point-scale	Items aggregated in R1	R2: MV (SD) on seven-point-scale	R3: MV (SD) on nine-point-scale
Firm reputation and brand image	3.91 (0.99)	7.33 (1.69)	Contribution to a complete picture of sustainability performance	5.68 (1.06)	7.20 (1.67)
Support of risk and compliance management	3.85 (0.95)	6.89 (1.83)	Contribution to long-term thinking	5.94 (1.11)	7.04 (2.18)
Establishment of long-term collaborative relationships	3.75 (1.04)	5.89 (1.69)	Contribution to the internalization of (external) environmental and social costs	5.58 (1.26)	6.24 (1.84)
Building of innovation capacities	3.36 (1.04)	5.48 (2.49)	Motivation for sustainability improvements	5.48 (1.46)	6.04 (1.34)
Frontrunner effects through a proactive stance towards social assessment	3.74 (1.00)	5.26 (2.26)	Clear demonstration of trade-offs	5.45 (1.19)	5.68 (1.76)
Profit and financial performance	3.14 (1.00)	3.93 (2.32)	Support of internal decision making	5.13 (1.31)	5.12 (1.37)
			May change the ranking among different product/investment/sourcing alternatives	5.10 (1.23)	4.88 (1.11)
			Dealing with positive benefits may be a better psychological driver towards sustainable development than dealing with negative issues	4.84 (1.48)	4.56 (1.39)
			Support of external communication	5.17 (1.64)	4.48 (2.12)
			Assessing positive benefits may increase the willingness to assess negative issues as well	4.52 (1.72)	3.16 (1.95)

Note. Items are prioritized by the mean values (MV) and standard deviations (SD) of ratings from the third and final round (R) in descending order.

Appendix VI: References of practice cases from the systematic review of corporate practice in chapter seven

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