



Exploration of the Barriers to Implementing Different Types of Sustainability Approaches

Stewart, Raphaëlle Marie Marianne; Bey, Niki; Boks, Casper

Published in:
Procedia CIRP

Link to article, DOI:
[10.1016/j.procir.2016.04.063](https://doi.org/10.1016/j.procir.2016.04.063)

Publication date:
2016

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

[Link back to DTU Orbit](#)

Citation (APA):
Stewart, R. M. M., Bey, N., & Boks, C. (2016). Exploration of the Barriers to Implementing Different Types of Sustainability Approaches. *Procedia CIRP*, 48, 22-27. <https://doi.org/10.1016/j.procir.2016.04.063>

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

23rd CIRP Conference on Life Cycle Engineering

Exploration of the barriers to implementing different types of sustainability approaches

Raphaëlle Stewart^{a,b*}, Niki Bey^a, Casper Boks^b

^a*Technical University of Denmark (DTU), Department of Management Engineering, Division of Quantitative Sustainability Assessment, Produktionstorvet, Building 424, 2800 Kgs. Lyngby, Denmark*

^b*Norwegian University of Science and Technology (NTNU), Department of Product Design, 7491 Trondheim, Norway*

* Corresponding author. Tel.: +45-4525 1642; E-mail address: rste@dtu.dk

Abstract

Integrating sustainability into business is gaining increased attention. Yet, implementing long-lasting sustainability approaches remains a complex task. Many empirical studies have identified the barriers to such implementation but the variation in challenges faced by companies, depending on the focus of the approach being implemented, is not addressed. The aim of this paper is i) to explore the barriers related to implementing different types of sustainability approaches and ii) to look for indications of similarities and differences across types of approaches. The research builds on data about the barriers, collected from a sample of twenty-two empirical studies in academic research and additional reports. The findings show that performance measurement systems and access to industry-specific information, benchmark or reference cases are common areas of difficulty across all types. The main variation is an increase in barriers beyond the company's boundaries, when shifting from a production to a value proposition focus. The results are limited by the unbalanced distribution of studies and the variety in methodologies present in the sample. Further research on barrier identification, prioritization and influential parameters is recommended.

© 2016 The Authors. Published by Elsevier B.V. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Peer-review under responsibility of the scientific committee of the 23rd CIRP Conference on Life Cycle Engineering

Keywords: Sustainability; approaches; implementation; empirical studies; barriers.

1. Introduction

Integrating sustainability considerations in business is gaining increased attention due to concerns of policy-makers, other external stakeholders, and companies' own agendas related to strategic and market positioning interests [1]. This has led companies to seek to develop their own sustainability approaches. An "approach" can generally be defined as a way of considering or doing something, dealing with a situation or a problem, and it often relates to a strategy and its underlying activities.

The matter of sustainability for a company relates to the concept of corporate sustainability. Based on a parallel with the definition of sustainable development established in the Brundtland report [2], the International Institute for Sustainable Development defines sustainable development

for business as "adopting business strategies and activities that meet the needs of the enterprise and its stakeholders today while protecting, sustaining and enhancing the human and natural resources that will be needed in the future" [3]. According to Bertels et al., business sustainability is defined as "managing the triple bottom line, i.e. taking into consideration financial, social, and environmental risks, obligations and opportunities in decision-making" [4].

The concept of corporate or business sustainability is associated with a wide set of challenges and aspects to take into account. However, it is often the case that companies only address part of the sustainability matter by focusing on certain aspects and/or on certain business activities. At the same time, different international and national regulations require tackling certain specific sustainability issues, while companies may as well select for their sustainability work a

number of additional sustainability aspects. For the purpose of this study, a sustainability approach is defined as “the way and method, voluntarily developed, for addressing one or several parts of the sustainability matter at a company”.

Many tools have been developed, refined and made available for companies [5,6]. Similarly, in a growing number of companies, pilot-projects and sustainability strategies are elaborated. Nonetheless, long-term implementation of sustainability approaches often fails, highlighting the complexity of the issue. Epstein et al. argue that even though most CEOs consider the importance of improving corporate sustainability performance, the very implementation of sustainability presents major challenges [7]. Pigozzo et al. contend that companies struggle to make Eco-design projects shift from pilots to anchored practices [5]. Preuss reveals that there may be a significant gap between “corporate rhetoric” about sustainable supply chain management in environmental policy statements and actual practices [8]. Høgevoid et al. argue that for a company to develop and implement a sustainable business model, it has to generate a shift in business practices and corporate culture, which is difficult to manage [9].

In this context, a broad set of empirical studies have been conducted by scholars to identify the barriers and challenges to the implementation of diverse sustainability approaches in companies, such as Cleaner Production [10–12], Eco-design [13,14], Sustainable Design [15], Design for Environment [16], Design for Sustainability [17], Environmental [18] or Sustainable Supply Chain Management [19–21], Green Business Model [22,23], etc. Such studies are usually based on case studies, using interviews, or surveys as prime sources of empirical data. They seek to highlight different factors or barriers that may hinder the implementation of the respective sustainability approaches. Nonetheless, the current body of knowledge does not appear to sufficiently address the potential variation in challenges and barriers faced by companies, depending on the type of sustainability approaches being implemented, although a change in focus could lead to different difficulties. The aim of this paper is i) to explore the barriers and challenges related to the implementation of different types of sustainability approaches and ii) to look for indications of similarities and differences across types.

Section 2 introduces the methodology chosen in the present study (scope definition, data collection process and elaboration of a matrix to support data analysis). In section 3, the results are presented with a focus on outlining similarities and differences across sustainability approaches. In section 4, the findings are discussed in the light of the limitations. Finally, section 5 contains a summary of the study and the key concluding remarks.

2. Methodology

2.1. Scope

Classifying sustainability approaches is not a straightforward task. Many classification frames are available in literature but they do not align, and there is a

risk for overlapping. For instance, the list of Sustainable Business Model archetypes provided by Bocken et al. includes “maximizing material and energy efficiency”, and “substitute with renewable and natural processes” [24] which could just as well be classified under Cleaner Production [25]. Bisgaard et al. include Green Supply Chain Management in their compendium of case studies of Sustainable Business Model innovations [22] while the approach stands on its own for many scholars [8,20,21]. In order to encompass the multitude and diversity of sustainability approaches, a classification key is proposed for the purpose of this study. It categorizes approaches depending on whether they focus on the production system, the product, the supply chain or the value proposition. Fig. 1 shows examples of sustainability approaches considered in this study, under each category.

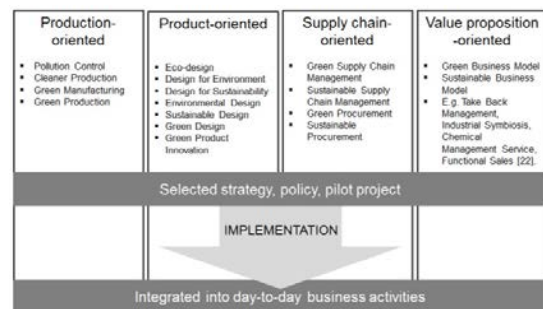


Fig. 1. Scope: Focus on four types of sustainability approaches, introduced with examples; focus for the implementation process, e.g. from strategy to integration into day-to-day business activities.

Moreover, the implementation process studied in this study refers to the shift from a specific sustainability strategy, policy or pilot project to its content being integrated into day-to-day business activities. This excludes the upstream process of implementing sustainability into the company strategy, a policy or a pilot project. In essence, the research presented here focuses on a situation where a company already has decided to engage into sustainability implementation. Fig. 1 shows the scope of this study.

2.2. Data collection

The research builds on data about the barriers to the implementation of the four sustainability approach types, collected from previously published empirical work. The search was performed using the database Scopus. The sample of studies was based on two criteria: the year of publication is between 2000 and 2015 and the focus is on a set of companies located in developed countries.

The sample mainly includes case studies, published in academic research articles. Most are based on interviews but in few cases, a survey is used, either as the main method or in addition to interviews. The studies focus on companies in various industries and of various sizes. For product-oriented approaches, which are addressed in a large set of papers, priority is given to most-cited articles. For value proposition-oriented approaches, there is little empirical content available in academic research articles. Thus,

studies published by other types of organizations are used. The sample of studies is reported in Table 1.

2.3. Matrix design

In order to bring all barriers together in a common frame and allow for comparison, a matrix is elaborated. The most common categorization method across literature is set between internal or organization-related and external or industry-related barriers [18,21,26–28]. The internal set includes, for instance, financial and other resource constraints, managerial and employee attitudes, poor communication and past practices [27]. The external set includes, for instance, capital costs, competitive pressures, industry regulation, technical information, green market opportunities and technical solutions [27]. Similarly, the first level of categorization in the presented matrix splits dimensions within and beyond the company's boundaries.

Table 1. Sample of empirical studies used in the present research.

Approach orientation	Empirical studies
Process	[10] [11] [12][28]
Product	[13] [14][15][16][17] [29] [30] [31] [32] [33]
Supply chain	[8][18] [19] [20] [21] [34]
Value proposition	[22] [23] ¹

In order to further structure the set of internal dimensions, the four-lens view upon organizations suggested by Bolman & Deal is used [35]. This includes structural, human, political and symbolic (here named cultural) aspects that should be taken into account when initiating a change within the organization [35]. This choice is consistent with considering sustainability integration as an organizational change [15] and with the need for abandoning a single bureaucratic view of organizations [36]. The structural dimension focuses on the architecture of the organization: the design of its units and subunits, the rules and roles as well as the goals and policies [35]. The human dimension focuses on understanding people, their strengths and weaknesses, their rationale and emotion as well as their desires and fears [35]. The political dimension focuses on the way to allocate scarce resources, the competing interests, and the fights for power and advantage [35]. Finally, the cultural dimension focuses on meaning, beliefs and faith, i.e. how humans make sense of the chaotic and ambiguous world in which they live [35].

Market, regulation, technology & tool and value network are the four entities used for structuring the set of external dimensions. The fourth entity is not commonly included in lists of barriers available in literature. It is added based on insights from Bertels et al. who argue that one reason for the complexity of implementing sustainability approaches lies in the high dependence on factors whose control is located beyond the company boundaries and that intense collaboration within the value network is often required for implementing sustainability [4]. A "value network" is

defined as a set of players, i.e. suppliers, partners, allies, consumers, working together to co-produce value [37].

The barriers mentioned in the empirical studies are reported under the relevant dimension in the matrix. For a specific barrier and a specific approach type, the cell contains an "X" if the barrier was highlighted in more than one of the related empirical studies and an "x" if it was outlined in a single study. It was decided to put no emphasis on the exact number of studies mentioning each barrier. This choice is consistent with the goal of the study and acknowledges that the empirical studies in the sample are not built on a single theoretical framework which does not allow for quantitative analysis of the barriers.

3. Results

The results of the comparison are displayed in Table 2 and Table 3. A code is provided for each barrier. Out of the fifty-nine barriers identified, two seem to be relevant across all approach types. These are non-adapted performance measurement systems (S8) and lack of industry-specific information, benchmarks or reference cases (T6). On the one hand, production-, product- and supply chain-oriented approaches and on the other hand, product-, supply chain- and value proposition-oriented approaches respectively show nine and ten barriers in common. The similarity in barriers for product- and supply chain-oriented approaches is remarkable: they share twenty-five barriers.

Within the company's boundaries, in the structural dimension, the difficulty to define relevant sustainability performance metrics or perform reporting (S3), the information aspect (S4), and the difficulties related to decision-making processes (S7) are highlighted in the context of production-, product- and supply chain-oriented approaches. S3 shows more evidence in the sample of studies than the other aspects. The information aspect is based e.g. on the absence of channels for bottom-up communication or on the fact that sustainability policy fails to communicate corporate commitment [10]. It is also raised in relation to the typical delay occurring between design decisions and information collection [29,33] and to the absence of company-specific filtering structure for environmental information [32]. Examples of difficulties related to the decision-making processes (S7) are lack of willingness to iterate among designers [29] and absence of environmental criteria in the conceptual phase, combined with other general flaws in design practice [17,31]. The lack of integration across functions within the organization (S5) is a common barrier for product-, supply chain- and value proposition-oriented approaches [13,20,23].

In the political dimension, difficulty to elaborate the business case and manage trade-offs (P1), low priority on agendas or short term priorities (P2) and lack of financial (P6) as well as time & human resources (P7) are common barriers to several approach types. They are all mentioned in more than one study for most approach types.

The human dimension is mainly outlined in studies on production and product approaches. The lack of skills, knowledge or training (H5) seems to be a recurrent barrier

¹Both studies for value proposition-oriented approaches were conducted in collaboration with a single research organization. Thus it limits the diversity of data inputs for this approach type.

in the context of product, supply chain and value proposition approaches. Knowledge issues can also materialize in difficulties to learn (H6) [11]. Lack of awareness (H1) shows different facets, e.g. it is stressed as being quite a poorly influential factor [8] or coupled with the regulatory context [31].

Table 2. Matrix of barriers within the company's boundaries, for the different approach types.

		Production	Product	Supply Chain	Value proposition
Barriers within company's boundaries					
<i>Structural dimensions</i>					
S1	Difficulty to scope / prioritize / set goals, lack of strategy		x	X	
S2	Lack of goal translation to functional / department basis		X	X	
S3	Difficulty to define relevant sustainability performance metrics / perform reporting	X	X	X	
S4	Issues of information filtering / flows / timing to support decision making	X	x	x	
S5	Lack of function integration / cooperation		x	x	x
S6	Lack of clear responsibility distribution		x	X	
S7	Difficulties related to decision making processes	x	X	x	
S8	Non-adapted performance measurement and incentive systems	x	x	X	x
S9	Locked-in situation related to capital / technology investments	x			
<i>Political dimensions</i>					
P1	Difficulty to elaborate business case, conflict, difficulty to manage trade-offs		X	X	X
P2	Low priority on agenda, short term priority	X	X	X	
P3	Lack of continuity due to changing agenda	x			
P4	Lack of alignment with other projects	x			
P5	Power of resisting versus promoting groups	x			
P6	Lack of financial resources	x		X	X
P7	Lack of time & human resources	x	X	X	
P8	Lack of local empowerment (department, business unit, subsidiary)	x		x	
P9	Lack of R&D / innovative capabilities	x	x		
<i>Human dimensions</i>					
H1	Lack of awareness		x	x	
H2	Lack of interest / commitment	x	x		
H3	Lack of involvement and empowerment	x	x		
H4	Lack of support from management for employees	x		X	
H5	Lack of skills/knowledge/training		X	X	x
H6	Difficulties linked to learning process	x			
H7	Fear to lose creativity / flexibility		x		
H8	Fear of work overload	x	X		
H9	Discomfort / uncertainty about topic		x		
H10	Difficulty to find sustainability ambassadors with necessary set of skills	x			
<i>Cultural dimensions</i>					
C1	Scepticism regarding potential benefits		X	X	
C2	Lack of entrepreneurial spirit / room for out-of-the-box thinking		X		x
C3	It is not the company's responsibility		X		
C4	Sustainability is a distraction		x		
C5	Language barriers		x		
C6	Sustainability is "not invented here"		X		
C7	Sustainability input is constraint / criticism		X		

The cultural dimension is stressed in the context of product-oriented approaches. Scepticism regarding potential benefits (C1) and lack of entrepreneurial spirit (C2) are the only exceptions. However, some studies do point out

cultural barriers in the context of other approaches, e.g. [10] and [21], be it in a fuzzy way.

Regulation is overall a common dimension of difficulty across approaches but in varying aspects: from either a matter of multiple, complex, changing regulations (R2) or to a lower extent, a matter of low legislative pressure (R3) in the context of production, product and supply chain approaches, regulation may also become an obstacle to innovation (R4) for value proposition approaches [23].

Low market demand or willingness to pay (M3) as well as lack of understanding and knowledge among customers (M2) and a difficulty to propose competitive offerings (M5) are mentioned for product, supply chain and value proposition approaches. In production-oriented approaches only the latter is outlined.

Within the technology & tool dimension, few similarities are seen apart from T6 previously identified and a dependency on available technology (T1). There is evidence that product-oriented approaches face the challenges of tool and framework customisation (T3), their complexity or high demand in resource (T4) and the difficulty to link them with other business concerns (T5).

In the reviewed literature, barriers related to the value network are nearly inexistent for production-oriented approaches but in case of high industry interdependency [28]. Product, supply chain and value proposition approaches are associated with many challenges related to the value network. Common barriers are lack of trust, reluctance to share information, make joint investment (V4), the risk of a current or future locked-in situation or lack of bargaining power (V5) and difficulty to collaborate within and coordinate the value network (V7). Value network is the main dimension of difficulty for value proposition-oriented approaches.

4. Limitations and discussion

The lack of consistency in theoretical frameworks across studies in the sample both triggered and challenged the present work. Such difference might have biased the barriers mentioned by the interviewees or identified in document analysis. Moreover, the unbalanced distribution of studies related to the different approach types leads to different levels of richness in terms of explored barriers. However, the purpose of this study was formulated to take these challenges into account and the discussion aims at putting the results into their perspective. It is also important to keep in mind the weak representativeness of value proposition-oriented approaches in the sample.

It is acknowledged that a lack of focus on cultural barriers in the sample of studies may be the reason for the poor evidence of this dimension being a key area of difficulty across types. The empirical results for product-oriented approaches would be an interesting basis for further field research in other approach contexts. Key terms such as scepticism, distraction, not-invented-here and constraint could be used for such a purpose.

Also concerning other dimensions, certain barriers mentioned in a study of a specific approach showing no

evidence within the approach or apparent resonance across approaches could be explored in future field research. Examples of this are fear of work overload, fear to lose creativity or flexibility and discomfort or uncertainty about sustainability [15], as well as lack of continuity [11] or consistency across projects within the company [10], fuzziness of regulation and customer messages [32], and increased scrutiny by stakeholders [30]. The matrix developed could be used as a framework for future research on the variation in barrier intensity across approaches.

Table 3. Matrix of barriers beyond the company's boundaries, for the different approach types.

		Production	Product	Supply chain	Value proposition
Barriers beyond company's boundaries					
Code	<i>Regulation</i>				
R1	Unclear / fuzzy message from regulation		x		x
R2	Multiple / complex / changing regulation	x	X	x	
R3	Low pressure from regulation /control	x		x	
R4	Regulation limits room for innovation				x
<i>Market</i>					
M1	Unclear / fuzzy message from customers		x	x	
M2	Lack of understanding / knowledge among customers		x	x	X
M3	Low market demand / willingness to pay		X	X	x
M4	Lack of influence on customers		x		
M5	Lack of competitiveness	x	X	X	
<i>Technology & tool</i>					
T1	Dependency on available technology	x	x		x
T2	High research costs / risks for new technologies	x			x
T3	Lack of framework / tool customisation	x	X		
T4	Complex / time consuming / information-intensive tools		X		
T5	Difficulty to make links with other business concerns when using tools		X		
T6	Lack of industry-specific information / benchmark / reference cases	x	X	x	x
<i>Value network</i>					
V1	Dependency on current infrastructure / value network setting	X		x	X
V2	Lack of understanding / knowledge			x	X
V3	Lack of commitment			x	x
V4	Lack of trust, reluctance to sharing information /making joint investments		x	X	X
V5	Current/future locked-in situation or lack of bargaining power against other players		x	X	X
V6	Difficulty to communicate and exchange data across the value network		x	X	
V7	Difficulty to collaborate within / coordinate the value network		x	x	X
V8	Discrepancy across accounting / contracting practices / incentives				X
V9	Risk of scrutiny by stakeholders		x	x	

The present research focuses on the variable “type of sustainability approach being implemented”. However, other parameters might have an influence. Verhulst & Boks reveal differences in barriers across the company departments [15]. Preuss highlights potential differences related to the company size, in terms of awareness, acknowledgement of company's responsibility and clear task distribution [8]. Van Hemel & Cramer outline that sustainability initiatives in an industrial sector play a role in

the implementation of Eco-design in this sector [14]. This relates to an idea of sector culture that could be further explored. Walker et al. recommend investigating the differences between private and public sectors [18]. Linnenluecke et al. argue that the barriers may vary on an employee individual basis, depending on the subculture to which the employee belongs [38]. These additional parameters would help better understand the relevant barriers in a given context as well as their interactions; Aschehoug et al. for example link the challenge of information filtering to the cultural framing of the groups receiving the information in the company [39]. If no systematic filtering mechanism is applied, the availability of information in the company remains uncontrolled [39].

Several scholars tend to support that internal barriers are the main obstacles to the implementation of sustainability in companies [4,33]. For instance, it is argued that the adoption of corporate sustainability principles happens through the adoption of a sustainability-oriented organizational culture [36]. Nonetheless, in the present study, external barriers – in particular regulation and access to industry-specific information, benchmarks or reference cases – seem to play a crucial role across approach types. This is consistent with the findings by Walker et al. [18].

It is further noticed that external barriers seem to play an increasingly intense role, when shifting from production- to value proposition-oriented approach. This finding may be related to the fact that the group of players, who may enable or impede, the long-lasting implementation into business activities, changes and grows, from mainly company-internal to beyond the company's boundaries, along with such a shift. Indeed, in a supply chain-oriented approach, the coordination and collaboration of the company with its suppliers is a necessary precondition to its long-lasting implementation. This is also the case for product-oriented approaches since they might involve action across the value chain. Similarly, in a value proposition-oriented approach, value network players have a key role in the offering's long-term success.

5. Conclusion

The aim of this paper was i) to explore the barriers related to the implementation of different types of sustainability approaches and ii) to look for indications of similarities and differences across types of approaches. For the exploration of barriers, the authors suggested and applied a categorization of sustainability approaches into four types according to the particular focus: production-, product-, supply chain- and value proposition-oriented approaches.

Data on the barriers to the implementation were collected from 22 empirical studies. A matrix was built to compare the barriers mentioned for different types of approaches. The matrix distinguishes between dimensions “within the company's boundaries” (being: structural, political, human and cultural) and “beyond the company's boundaries” (being: regulation, market, technology & tool and value network).

Within the company's boundaries, the non-adaptation of performance measurement systems is highlighted as a common barrier across approach types. Beyond the company's boundaries, the lack of industry-specific information, benchmark or reference cases is outlined as a recurrent challenge. Other similarities across several approach types were explored. The apparent lack of similarities between some dimensions may be due to the unbalanced distribution of studies and the lack of methodology consistency across studies. The main variation across types is an increase in external barriers, when shifting from production to value proposition orientation.

As a central contribution, this paper presents a large set of potential barriers and structures these into eight dimensions but it does not propose any prioritization or customization key. Future research could focus on identifying criticality and priority areas, depending on other parameters such as the company size or sector, as well as the department or group of employees being studied. It could also be relevant to relate the barriers to necessary factors that a company should secure before, or actively manage while, undertaking a certain sustainability approach. For instance, it could be investigated whether a certain value network sustainability "maturity" is necessary to the long-lasting success of a value proposition approach.

6. References

- [1] N. Bey, M. Z. Hauschild, and T. C. McAloone, "Drivers and barriers for implementation of environmental strategies in manufacturing companies," in *CIRP Annals - Manufacturing Technology*, 2013, vol. 62, pp. 43–46.
- [2] World Commission on Environment and Development, *Our Common Future (The Brundtland Report)*. Oxford: Oxford University Press, 1987.
- [3] International Institute for Sustainable Development (IISD), *Business strategy for sustainable development*. IISD, 2001.
- [4] S. Bertels, L. Papania, and D. Papania, "Embedding sustainability in organizational culture: A systematic review of the body of knowledge," 2010.
- [5] D. C. A. Pigosso, H. Rozenfeld, and T. C. McAloone, "Ecodesign maturity model: a management framework to support ecodesign implementation into manufacturing companies," *J. Clean. Prod.*, vol. 59, pp. 160–173, 2013.
- [6] M. P. Johnson and S. Schaltegger, "Two Decades of Sustainability Management Tools for SMEs: How Far Have We Come?," *J. Small Bus. Manag.*, vol. Early View, no. n/a, p. n/a, 2015.
- [7] M. J. Epstein and A. R. Buhovac, "Solving the sustainability implementation challenge," *Organ. Dyn.*, vol. 39, pp. 306–315, 2010.
- [8] L. Preuss, "Rhetoric and Reality of Corporate Greening: a View from the Supply Chain Management Function," *Bus. Strateg. Environ.*, vol. 14, pp. 123–139, 2005.
- [9] N. M. Høgevoold, G. Svensson, and C. Padin, "A sustainable business model in services: an assessment and validation," *Int. J. Qual. Serv. Sci.*, vol. 7, no. 1, pp. 17–33, 2015.
- [10] L. J. Stone, "Limitations of cleaner production programmes as organisational change agents. II. Leadership, support, communication, involvement and programme design," *J. Clean. Prod.*, vol. 14, pp. 15–30, 2006.
- [11] G. Zilahy, "Organisational factors determining the implementation of cleaner production measures in the corporate sector," *J. Clean. Prod.*, vol. 12, pp. 311–319, 2004.
- [12] I. Vickers, "Cleaner production: organizational learning or business as usual? An example from the domestic appliance industry," *Bus. Strateg. Environ.*, vol. 9, pp. 255–268, 2000.
- [13] C. Boks, "The soft side of ecodesign," *J. Clean. Prod.*, vol. 14, pp. 1346–1356, Jan. 2006.
- [14] C. van Hemel and J. Cramer, "Barriers and stimuli for ecodesign in SMEs," *J. Clean. Prod.*, vol. 10, pp. 439–453, 2002.
- [15] E. Verhulst and C. Boks, "The role of human factors in the adoption of sustainable design criteria in business: evidence from Belgian and Dutch case studies," *Int. J. Innov. Sustain. Dev.*, vol. 6, no. 2, pp. 146–163, 2012.
- [16] M. Lenox, A. King, and J. Ehrenfeld, "An Assessment of Design-for-Environment Practices in Leading US Electronics Firms," *Interfaces (Providence)*, vol. 30, no. 3, pp. 83–94, 2000.
- [17] A. Lee-Mortimer and T. Short, "The Product Development Process roadblock that is restricting the widespread adoption of Design for Sustainability," in *International Conference on Engineering Design*, 2009, pp. 331–342.
- [18] H. Walker, L. Di Sisto, and D. McBain, "Drivers and barriers to environmental supply chain management practices: Lessons from the public and private sectors," *J. Purch. Supply Manag.*, vol. 14, no. 1, pp. 69–85, 2008.
- [19] O. Morali and C. Searcy, "A Review of Sustainable Supply Chain Management Practices in Canada," *J. Bus. Ethics*, vol. 117, pp. 635–658, 2013.
- [20] J. Wolf, "Sustainable Supply Chain Management Integration: A Qualitative Analysis of the German Manufacturing Industry," *J. Bus. Ethics*, vol. 102, pp. 221–235, 2011.
- [21] H. Walker and N. Jones, "Sustainable supply chain management across the UK private sector," *Supply Chain Manag. An Int. J.*, vol. 17, no. 1, pp. 15–28, 2012.
- [22] T. Bisgaard, K. Henriksen, and M. Bjerre, "Green Business Model Innovation: Conceptualisation, Next Practice and Policy," Oslo, 2012.
- [23] Fora, "Green business models in the Nordic Region: A key to promote sustainable growth," Copenhagen, 2010.
- [24] N. M. P. Bocken, S. W. Short, P. Rana, and S. Evans, "A literature and practice review to develop sustainable business model archetypes," *J. Clean. Prod.*, vol. 65, pp. 42–56, 2014.
- [25] P. Glavič and R. Lukman, "Review of sustainability terms and their definitions," *J. Clean. Prod.*, vol. 15, pp. 1875–1885, 2007.
- [26] J. E. Post and B. W. Altman, "Managing the Environmental Change Process: Barriers and Opportunities," *J. Organ. Chang. Manag.*, vol. 7, no. 4, pp. 64–81, 1994.
- [27] F. Dahlmann, S. Brammer, and A. Millington, "Barriers to proactive environmental management in the United Kingdom: Implications for business and public policy," *J. Gen. Manag.*, vol. 33, no. 3, pp. 1–20, 2008.
- [28] E. H. M. Moors, K. F. Mulder, and P. J. Vergragt, "Towards cleaner production: barriers and strategies in the base metals producing industry," *J. Clean. Prod.*, vol. 13, pp. 657–668, 2005.
- [29] R. B. Handfield, S. A. Melnyk, R. J. Calantone, and S. Curkovic, "Integrating Environmental Concerns into the Design Process: The Gap between Theory and Practice," *IEEE Trans. Eng. Manag.*, vol. 48, no. 2, pp. 189–208, 2001.
- [30] R. M. Dangelico and D. Pujari, "Mainstreaming Green Product Innovation: Why and How Companies Integrate Environmental Sustainability," *J. Bus. Ethics*, vol. 95, pp. 471–486, 2010.
- [31] P. Deutz, M. McGuire, and G. Neighbour, "Eco-design practice in the context of a structured design process: an interdisciplinary empirical study of UK manufacturers," *J. Clean. Prod.*, vol. 39, pp. 117–128, 2013.
- [32] A. A. Alblas, K. Peters, and J. C. Wortmann, "Fuzzy sustainability incentives in new product development," *Int. J. Oper. Prod. Manag.*, vol. 34, no. 4, pp. 513–545, 2014.
- [33] S. Poulidikou, A. Björklund, and S. Tyskeng, "Empirical study on integration of environmental aspects into product development: processes, requirements and the use of tools in vehicle manufacturing companies in Sweden," *J. Clean. Prod.*, vol. 81, pp. 34–45, 2014.
- [34] N. Delaye, B. Householder, and J. Thatcher, "Sustainable supply chains: Making value the priority," 2014.
- [35] L. G. Bolman and E. D. Terrence, *Reframing Organizations: Artistry, Choice and Leadership*, 4th ed. San Francisco: Jossey-Bass, 2008.
- [36] M. K. Linnenluecke and A. Griffiths, "Corporate sustainability and organizational culture," *J. World Bus.*, vol. 45, pp. 357–366, 2010.
- [37] J. Peppard and A. Rylander, "From Value Chain to Value Network: Insights for Mobile Operators," *Eur. Manag. J.*, vol. 24, no. 2–3, pp. 128–141, 2006.
- [38] M. K. Linnenluecke, S. V. Russell, and A. Griffiths, "Subcultures and Sustainability Practices: The Impact on Understanding Corporate Sustainability," *Bus. Strateg. Environ.*, vol. 18, pp. 432–452, 2009.
- [39] S. H. Aschehoug, C. Boks, and S. Støren, "Environmental information from stakeholders supporting product development," *J. Clean. Prod.*, vol. 31, pp. 1–13, 2012.