Supplementary Material S1: List of barriers to SSCM implementation.

Table S1. List of barriers to the implementation of sustainable supply chain management resulting from the literature review.

Category and barrier to the implementation of SSCM
Technological
1. Lack of technology to facilitate resource optimization
2. Lack of technical knowledge and training
3. Failure to move beyond design
4. Lack of research and development (R&D) and innovation capacity
5. Lack of waste management and recycling facilities
6. Lack of technological solutions for effective environmental measures
7. Lack of new technologies, materials, and processes and their sharing
8. Complexity of the green process and system design
9. Lack of sustainable communication technologies
10. Lack of implementation of information technology (IT) solutions for communication and coordination
Economic and financial
11. Lack of funds for a sustainable production practice
12. Lack of capital to carry out innovation activities
13. High transaction costs
14. High investment and perceived low economic return
15. Uncertain benefits
16. High cost of implementation and maintenance
17. High cost of disposing of hazardous waste
18. Cost of environmentally friendly packaging
19. Poor economic conditions
20. Pressure for lower prices
21. Unwillingness to share risks and rewards
22. Low funds availability
23. Lack of promotions of sustainable products
Supplier
24. Scarcity of sustainable suppliers
25. Lack of trust between supply chain partners
26. Lack of a reward system for suppliers
27. Reluctance to support by supply chain partners
28. Low supplier commitment
29. Few (weak) links to suppliers
30. Lack of responsibility towards the producer
Information
31. Uncertainty of the green outcome
32. Fear of failure
33. Lack of information sharing
34. Lack of awareness of environmental impacts in companies
35. Lack of understanding regarding market competition
36. Lack of knowledge and training on reverse logistics
37. Ineffective training and education on information systems
Market and networking
38. Misunderstanding the different types of customers

Category and barrier to the implementation of SSCM
39. Low market demand
40. Lack of understanding from customers
41. Lack of competitiveness
42. Unwillingness to collaborate
43. Mistrust of sharing information and forming joint ventures
44. Lack of customer awareness of green products
45. Insufficient consumer support and encouragement
Human resources
46. Lack of work culture
47. Lack of technical knowledge on sustainability
48. Lack of training and information on sustainable practices
49. Lack of training courses and institutions to train specific staff
Social and cultural
50. Perception that sustainable products are of poor quality
51. Fear of extra workload and loss of flexibility
52. Lack of entrepreneurial skills and thinking outside the box
53. Negative attitudes towards sustainability concepts
54. Popularity of traditional technologies
55. Corruption
Regulatory and institutional
56. Inadequate institutional framework
57. Lack of laws and legislation
58. Lack of incentives
59. Multiple, complex, and changing regulations
60. Bureaucratic and lengthy documentation process
61. Lack of guidance and support from regulatory authorities
62. Lack of awareness among external stakeholders
63. Lack of government support for adopting sustainable manufacturing practices
64. Outdated auditing standards
Organizational
65. Lack of performance measurement and incentive systems
66. Inability to integrate and cooperate between organizational functions
67. Lack of clear responsibility and difficulty in making decisions
68. Failure to empower lower levels
69. Insufficient commitment from top management
70. Inadequate communication
71. Lack of environmental objectives
72. Inadequate strategic planning of the supply chain
73. Lack of commitment to corporate social responsibility (CSR)
74. Restrictive company policies for product/process management
75. Misalignment between short- and long-term strategic objectives
76. Lack of resources
77. Inadequate leadership capacity, both in visionary and supportive leadership
78. Reduced employee involvement and participation
79. Replicating another organization's SSCM strategy
80. Lack of an effective model to guide SSCM implementation

Supplementary Materials S2: Evaluation of the importance of barriers and main categories based on the BWM technique.

Table S2. Pairwise comparison of Technological barriers

Best-to-Others							
Best Criterion	**T1**	**T2**	**T3**	**T4**	**T5**	**T6**	**T7**
T3	3	2	1	4	7	3	4
Others-to-Worst							
Worst Criterion	**T1**	**T2**	**T3**	**T4**	**T5**	**T6**	**T7**
T5	4	6	7	3	1	4	5

Table S3. Pairwise comparison of Economic and financial barriers

Best-to-Others							
Best Criterion	**EF1**	**EF2**	**EF3**	**EF4**	**EF5**	**EF6**	**EF7**
EF1	1	2	3	3	5	7	4
Others-to-Worst							
Worst Criterion	**EF1**	**EF2**	**EF3**	**EF4**	**EF5**	**EF6**	**EF7**
EF6	7	6	5	5	3	1	4

Table S4. Pairwise comparison of Supplier barriers

Best-to-Others				
Best Criterion	**S1**	**S2**	**S3**	**S4**
S3	7	4	1	5
Others-to-Worst				
Worst Criterion	**S1**	**S2**	**S3**	**S4**
S1	1	4	7	3

Table S5. Pairwise comparison of Information barriers

Best-to-Others						
Best Criterion	**I1**	**I2**	**I3**	**I4**	**I5**	**I6**
I6	5	8	3	4	7	1
Others-to-Worst						
Worst Criterion	**I1**	**I2**	**I3**	**I4**	**I5**	**I6**
I2	4	1	6	3	2	8

Table S6. Pairwise comparison of Market and networking barriers

Best-to-Others						
Best Criterion	**MN1**	**MN2**	**MN3**	**MN4**	**MN5**	**MN6**
MN6	3	5	6	7	2	1
Others-to-Worst						
Worst Criterion	**MN1**	**MN2**	**MN3**	**MN4**	**MN5**	**MN6**
MN4	4	5	3	1	6	7

Table S7. Pairwise comparison of Human resources barriers

Best-to-Others				
Best Criterion	**HR1**	**HR2**	**HR3**	**HR4**
HR3	8	3	1	5
Others-to-Worst				
Worst Criterion	**HR1**	**HR2**	**HR3**	**HR4**
HR1	1	6	8	4

Table S8. Pairwise comparison of Social and cultural barriers

Best-to-Others						
Best Criterion	**SC1**	**SC2**	**SC3**	**SC4**	**SC5**	**SC6**
SC6	3	5	2	4	8	1
Others-to-Worst						
Worst Criterion	**SC1**	**SC2**	**SC3**	**SC4**	**SC5**	**SC6**
SC5	5	3	6	4	1	8

Table S9. Pairwise comparison of Regulatory and institutional barriers

Best-to-Others						
Best Criterion	**RI1**	**RI2**	**RI3**	**RI4**	**RI5**	**RI6**
RI2	2	1	3	4	7	3
Others-to-Worst						
Worst Criterion	**RI1**	**RI2**	**RI3**	**RI4**	**RI5**	**RI6**
RI5	5	7	4	3	1	6

Table S10. Pairwise comparison of Organizational barriers

Best-to-Others									
Best Criterion	**O1**	**O2**	**O3**	**O4**	**O5**	**O6**	**O7**	**O8**	**O9**
O2	3	1	4	2	3	4	4	5	8
Others-to-Worst									
Worst Criterion	**O1**	**O2**	**O3**	**O4**	**O5**	**O6**	**O7**	**O8**	**O9**
O9	5	8	4	6	5	4	5	4	1

Table S11. Pairwise comparison of main categories

Best-to-Others									
Best Criterion	**T**	**EF**	**S**	**I**	**MN**	**HR**	**SC**	**RI**	**O**
EF	2	1	7	5	4	6	5	2	2
Others-to-Worst									
Worst Criterion	**T**	**EF**	**S**	**I**	**MN**	**HR**	**SC**	**RI**	**O**
S	7	8	1	5	4	3	4	7	7