

A Contingency Based Approach To Green Supply Chain Management: How Contextual Factors Influence Practices and Performance

*Guido Regaldo (Guido.Regaldo@mail.polimi.it)
Politecnico di Milano*

Abstract

This paper investigates the adoption of Green Supply Chain Management (GSCM) by manufacturing companies operating in Italy. Taking cue from the contingency theory, are analyzed behaviors and outcomes of Italian companies in different contexts. Results reveal that the contexts in some cases have a relevant influence on the quantity and typology of GSCM practices adopted and also in their relation with environmental performance. Differently from previous results, have also been discovered clusters of companies that manage to have significant better environmental performance even if with a lower practices adoption. Results have implication for Italian companies that could find the best environmental solutions relating to the particular business and pressure contexts in which they operate.

Keywords: Green Supply Chain Management, Contingency Theory, Performance

Introduction

A number of authors have referred to the green supply chain over the past decade due to emerging environmental management topics.

The growth in this green supply chain literature extends back to the early 1990s with the advent of corporate environmental management, environmentally conscious manufacturing strategy and supply chain management literature (Zhu & Sarkis, 2006).

To simply understand Green Supply Chain Management (GSCM) issue, can be useful to go through the answer of the five Ws and one H (What, When, Where, Who, Why and How).

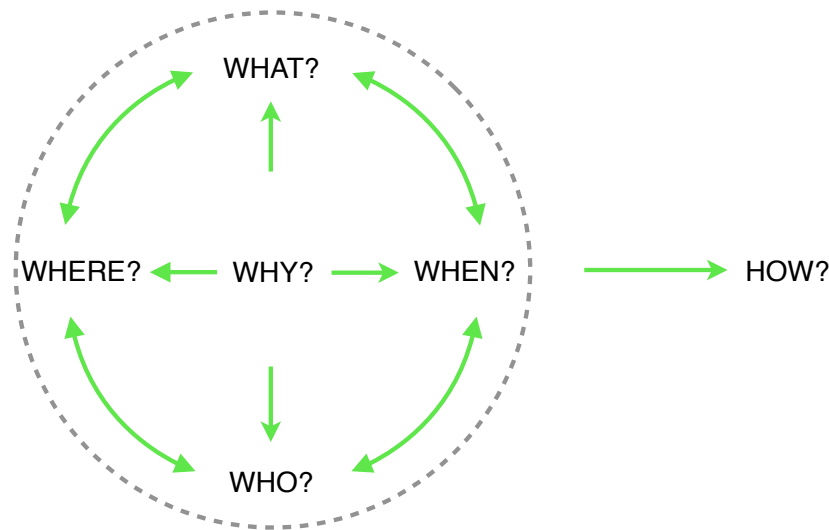


Figure 1: GSCM five Ws and one H

Through a review of the most used GSCM definitions is possible to have a look at **What** GSCM is and to understand how its interpretation has changed over the years.

One of first definitions is by Green et al. (1996) that wrote: “green supply refers to the way in which innovations in supply chain management and industrial purchasing may be considered in the context of the environment”.

In 2007 Srivastava explained GSCM as “integrating environmental thinking into supply chain management, including product design, material sourcing and selection, manufacturing processes, delivery of the final products to the consumers, and end of life management of the product after its useful life”.

In a more wide perspective, GSCM is a fundamental part of Sustainable Supply Chain Management (SSCM), defined by Carter & Rogers (2008) as “the strategic, transparent integration and achievement of an organization’s social, environmental, and economic goals in the systemic coordination of key inter-organizational business processes for improving the long-term economic performance of the individual company and its supply chains”. This definition focuses the attention not only on environmental but also on social and economic issues, forming the three recognized dimensions of sustainability also referred as the Triple Bottom Line (3BL) (Sharfman *et al.*, 2009). The concept of sustainability was defined in the 1987 by the World Commission on Environment and Development (WCED) as “development which meets the needs of the present without compromising the ability of future generations to meet their own needs”.

Looking at the evolution of the GSCM definitions we can see that through the years there has been an increasing focus on the explanation of where and when GSCM has to be applied, as on its integration with the other two sides of sustainability.

Trying to give an answer to **When** GSCM apply is useful to see its time dependency. In particular, starting from GSCM definitions, is possible to outline two types of time dependency.

The first relate to the product/service and Srivastava (2007) explains it well because GSCM does not concentrate only on a particular point during the life of the product but starts before the product is even born, with “design practices”, and continues also after the product has finished its life with “end of life management”.

The second type of time dependency regards the kind of relationship necessary to develop a successful GSCM. As Carter & Rogers (2008) suggest the aim is to build long term cooperations with the other shareholders via long term contracts. To assist such a long time cooperation is necessary to establish different and enhanced way of communications and knowledge sharing throughout the chain, as different forms of collaborations (three C’s) like cross-functional teams and suppliers and customers development (Beske, 2012; Seuring & Muller, 2008; Ellinger, 2000).

To understand **Where** GSCM applies is necessary to recall the definitions of Supply Chain (SC). La Londe & Masters (1994) proposed that a supply chain is a set of firms that passes materials forward. These firms are responsible in manufacturing a product and placing it in the hands of the end user in the supply chain. Raw materials and components producers, products assemblers, wholesalers, retailer merchants, transportation companies and final consumers are all members of a supply chain.

In 2001 Mentzer *et al.* defined the supply chain as a set of three or more entities (organizations or individuals) directly involved in the upstream and downstream flows of products, services, finances, and/or information from a source to a customer.

After recalling some of the supply chain definitions is possible to conclude that GSCM can applies at any firm along the supply chain, starting upstream with raw materials producers and arriving downstream with final consumers. If thinking at the supply chain as a river, any point of this river may be subject of practices designed to improve the flowing of the water.

The stakeholder theory can help to answer the question of **Who** can apply GSCM. In the older view, there were only four parties which wishes and desires the company had to satisfy: investors, employees, suppliers and customers (Clarkson, 1995).

The stakeholder theory instead argues that there are also others actors linked with the company that can, in some way, influence its initiatives. These other stakeholders are communities, political groups, governmental bodies, prospective customers, etc. (Carter & Easton, 2011; Phillips & Freeman, 2003). All these stakeholders are involved in GSCM, directly or indirectly. Studies as that of Sarkis *et al.* (2010) have established the influence of stakeholder pressures on the adoption of environmental practices.

After a short briefing on GSCM meaning, answer to the question of **Why** to implement GSCM is both fundamental and very simple.

Global warming, pollution, depletion of natural resources, biodiversity extinction and expected population growth should be enough reasons to deal urgently with environmental issues. During the last years governments, companies and communities have increased their commitment but, often, the problem is not seen as urgent as it is and many objectives that could be immediately pursued are procrastinated to future generations.

The link between nature and companies was clear to Hart that in 1995 developed the “Natural Resource Based” view, a theory of competitive advantage based upon the firm’s relationship with the natural environment. According to Hart in the future would have been inevitable that business (market) would have become constrained by and dependent upon ecosystems (nature). To succeed in such a context, so, would have been always more important to develop environmentally sustainable economies activities (Hart, 1995).

To achieve such objectives the company can not work alone because, If we look only at the single company, it could be theoretically possible to become totally carbon free by outsourcing all the production. Clearly, this quite adopted practice among some companies, does not resolve the problem but just shifts it up or down the supply chain leaving to other actors the responsibility. So a wider and long term application of green practices has become fundamental and in this context GSCM finds its natural place (Emmett & Sood, 2010).

As has been said before, many actors have the power to influence companies to adopt green practices but, when it comes the time to choose what to do, a big problem arises. In fact considering the great amount of practices available, is normal to assume that companies will not be able to implement all of them or to find by themselves the “locus of investment” (Narasimhan *et al.*, 2008).

The aim of this paper is, so, to contribute to answer the last important question: “**How** to positively apply GSCM through an ad hoc green practices implementation”.

Background and Research Objectives

During the last thirty years some events have radically changed the vision of the company and of its integration in the surrounding environment.

Significant was the quality revolution of 1980s and the supply chain revolution of 1990s, during which individual enterprises became members of larger networks that evolved from “standalone” units to integrated supply chains (Vachon & Mao, 2008). This integration led first to supply chain concerns that subsequently merged with sustainability needs into the concept of GSCM (Caniato *et al.*, 2011). Carter & Roger (2008) suggested that engaging in sustainability, and SSCM in particular, was not discretionary, but rather a requirement. According to the work of Seuring & Muller (2008), the first papers regarding sustainable development along the supply chain have

seen publication in 1994 and during the following years the rate of publications has gradually increased. Among these works, is possible to see different research methodologies: theoretical and conceptual papers, case studies, surveys, modeling papers and literature reviews.

Either methodology is used, the research focus on one or more of these subjects:

- Pressure/Drivers to adopt green practices;
- Barriers that hinder green practices implementation;
- Practices implemented;
- Performance gained;



Figure 2: Path from pressure/drivers to performance through practice implementation

The logic of GSCM practices implementation is described in Figure 2. The first input is any sort of pressure/driver the company receives. The pressure/driver makes the company think to adopt certain practices and this usually can lead to face some barriers that hinder the implementation. After overcoming the barriers the practices can finally be realized and their performance evaluated. It can also happen that the barriers are not present or are easily overcome, allowing an immediate transition from pressure/drivers to practices implementation.

In this paper the focus is on environmental performance gained from green practices adoption, so has been done the hypothesis that barriers are not present or have been already overcome. Looking at Figure 2 it is clear that to implement a green practice the barriers can no longer exist, otherwise the GSCM process will stop immediately.

When a company decides to implement a green practice this is always a consequence of a particular driver and/or pressure. The word “pressure” is often used more when referring to something that is imposed to the company and that forces it to implement particular green practices, independently of their efficiency and impact on company performance. So an example of pressure could be the environmental policies established by the European Union, as RoHS (the restricted use of hazardous substances in electrical and electronic equipment) and WEEE (waste electronics and electrical equipment) directives. The word “driver” is instead used more when referring to some actions or conditions that lead the company to adopt a particular green practice, considered to be related to some sort of efficiency and increase in performance.

In other words, usually, “pressure” lead to a passive adoption while “drivers” lead to a proactive adoption of green practices. Sousa & Voss (2008) distinguished between these efficiency and non-efficiency factors identified as drivers of adoption of OM practices

in manufacturing operations. In the following of this paper will refer to pressure or to driver basing on the particular context.

One of the most used classification is reported by Walker et al. (2008), dividing the drivers between internal and external ones. This distinction refers to where the drivers come from, if within the organization or outside it. The drivers coming from outside the organization are further divided in: regulatory, customers, competition, society and suppliers. This distinction is however not exhaustive because it focuses mainly on the source of the pressure and not on its typology. Starting from this gap the institutional theory perspective (Meyer & Rowan, 1977) comes in help. According to DiMaggio & Powell (1983) the business choices are not all the result of rational economic decisions but are influenced by external norms, values and traditions, resulting in three institutional pressures: coercive, mimetic and normative. Coercive pressures are formal or informal pressures applied by an organization on organizations upon which they are dependent, via governmental legislation and cultural expectations within society. Normative pressures stem from professionalization and these pressures manifest themselves in the form of organizations following an industry norm. Finally, Mimetic isomorphism is a response to ambiguous situations and result from organizations mimic the responses of other organizations (DiMaggio & Powell, 1983).

In response to these pressure, companies apply certain practices to achieve objectives and performance required. To choose the right practice is so a fundamental step in GSCM and can make the difference between a successful or disastrous green practices implementation, even more if considering that the results will reflect on the entire supply chain. In the research by Hervani et al. (2005) the practices are divided on the basis of GSCM definition, where the “green” component has been added to the supply chain management. Zhu & Sarkis have realized many research on this subject and in particular in Zhu & Sarkis (2006) have been studied the level of practices implementation in chinese industries and have been grouped the practices in green purchasing, cooperation with customers including environmental requirements, investment recovery, eco design and internal management. Another perspective, that can help dividing the practices in clusters, is the one used by Klassen & Vachon (2003). In their study on GSCM, they decided to concentrate the attention on two dimensions of green supply chain activities: collaboration and evaluation. Collaborative practices are the ones that require some interaction with suppliers and/or customers to achieve sustained improvements in environmental performance, while evaluative practices concern information gathering to assess and to monitor environmental management and performance of suppliers. This different perspective is particularly useful because it focuses more on the types of interactions between *Who* along the supply chain can implement green practices, while Zhu & Sarkis (2006) focus more on *Where* and *When* to apply them.

The implementation of practices leads to performance that are the core objective of any company. Economical performance is the essential one because no company can bear, on long-term, to spend more than what it earns. Environmental performance instead is the crucial future performance with objectives far more big than the survival of a single company. Performance evaluation becomes so a crucial step with precise objectives.

The first one is to assess what has been done so to learn, both from successful and unsuccessful implementation. Only through an assessment of the results gained is possible to decide what to do next. The last objective of performance evaluation is to motivate people and organizations involved, so to obtain even more commitment for current and future aims.

Usually researchers, after individually evaluated pressure, practices and performance, work at the most challenging aim that is to find the right interpretation of the relationships between pressure and practices and between practices and performance. Only understanding the link between them is possible to give a real contribution to GSCM subject. Examples of the latest efforts in this direction are the works of Micheli *et al.* (2011) and of Azevedo *et al.* (2011).

A conclusion that has been verified many times is that, on average, companies implementing more practices obtain better performance (e.g., Zhu *et al.*, 2011). Based on these analysis, companies could be brought to think that the key to obtain better environmental performance is just to implement more practices as possible or just chose from the ones that are the most implemented or considered the best performance carrier. However it happens that companies doing this does not achieve the performance expected, or happens that the same practices lead to different results in different companies. So, what is missing in GSCM research, is a comprehensive study on the possible reasons of this mismatch between research results and companies results.

To do this come in help the contingency approach, based on contingency theory.

According to this theory there is a shift in interest from the justification of the value of “best” practices to the understanding of the contextual conditions under which they are effective (Sousa & Voss, 2008). Contingency approach has been already used in different topics as in Bozarth & Chapman (1996), where have been studied time-based competition (TBC), or in Sousa & Voss (2008), where have been investigated operation management (OM) best practices.

Based on the analysis above, the Research Objectives (ROs) are the following:

- RO1. To apply Contingency analysis to GSCM, choosing the most relevant contexts;
- RO2. To explore the level of adoption of GSCM practices in different contexts;
- RO3. To explore to which degree GSCM practices can lead to environmental performance in different contexts;

- RO4. To understand how strong is the relationships between GSCM practices and environmental performance in different contexts.

Research Model and Methodology

The data have been taken from a cross-sectorial survey, regarding GSCM, that was conducted from September to December 2009. The survey, inspired by the works of Joseph Sarkis (Zhu & Sarkis, 2006; Hervani et al., 2005; Zhu & Sarkis, 2004), consists of 111 questions divided in four sections:

- Section 1: Business information of the companies and supply chain;
- Section 2: GSCM pressure and drivers;
- Section 3: GSCM practices;
- Section 4: GSCM performance.

The first section contains 34 questions regarding general informations of the company and of its business. These informations are the ground above which apply the contingency theory because, starting from these data, is possible to divide the companies in clusters based on the same particular context.

The other 3 sections regard GSCM pressure, GSCM practices and GSCM performance and the framework is shown in Figure 3.

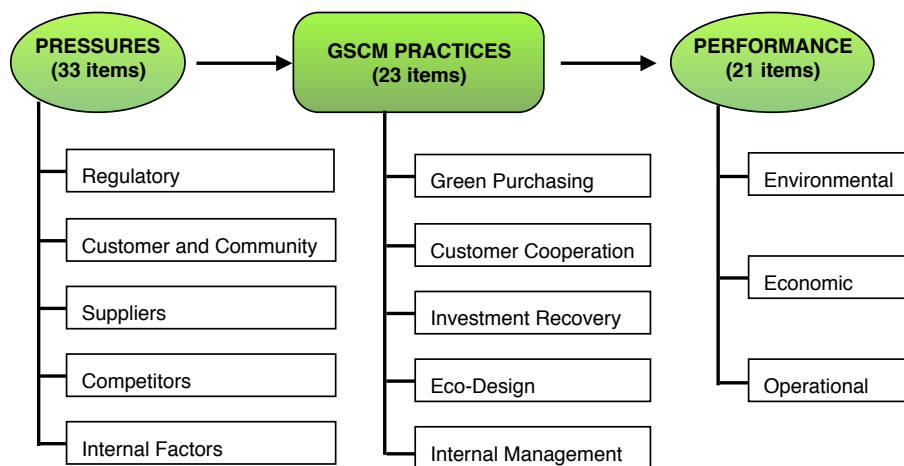


Figure 3: Research model

In December 2009 were been received a total of 100 responses for a total survey rate of 10,14%. The respondents had to answer using a 5-point Likert scale to determine: the level of GSCM pressure, the level of implementation of GSCM practices and the change in performance related to GSCM practices adoption.

Starting from these data, validated in Micheli *et al.* (2011), the first objective has been to choose the most relevant contexts (RO1) to be used in this contingency analysis. To do this has been made a literature review and have been selected 19 significant contexts from the information within the survey. They are summarized in Table 1.

Table 1: Different levels of the 19 contexts studied

Context	Levels
1. Company dimension	Small; Medium; Medium-large; Large
2. Belonging to a group	Yes; No
3. Production strategy	MTS; MTO-ATO; ETO; ITO
4. Prospective supply chain	No; Yes
5. Number of supply chain served	One; More than one
6. Role in the supply chain	First-tier supplier; Second-tier supplier; OEM contractor
7. Way of interaction with other actors	Receiving directions; Passive cooperation; Peer to peer cooperation; Active cooperation; Dictating directions
8. Replaceability	Low; Medium; High
9. Green image pressure	Not relevant; Relevant
10. Product and internal processes pressure	Not relevant; Relevant
11. Non local customer pressure	Not relevant; Relevant
12. Community pressure	Not relevant; Relevant
13. Supply chain pressure	Not relevant; Relevant
14. Internal factors pressure	Not relevant; Relevant
15. Competitors pressure	Not relevant; Relevant
16. Regulatory pressure	Not relevant; Relevant
17. Company performance versus competitors'	Poorer; The same; Better
18. Supply chain performance versus competitors'	Poorer; The same; Better
19. Performance trend of the last 3 years versus competitors'	Poorer; The same; Better

Regarding RO2, a descriptive analysis has been performed, with the hypothesis:

- *H2.1* Companies in different contexts apply different typology of GSCM practices;
- *H2.2* Companies in different contexts apply different quantity of GSCM practices;

For RO3 in particular has been done the following hypothesis, to be tested with empirical data:

- H3.1 Companies in different contexts achieve different level of environmental performance;
- H3.2 In some contexts companies with lower level of GSCM practices adoption achieve better environmental performance;

Finally, to understand how strong is the relationship between GSCM practices and environmental performance in different contexts (RO4), has been conducted a correlation analysis. Other performance have been deliberately excluded from this analysis because the idea is not to find practices that provide a compromise between different performance, but to find the best solutions in environmental area. According to this, the future important question will not be *if* these solutions are also sustainable in an economic and social way but *how* to make this possible.

Looking at the visual representation of the 3BL in Figure 4, the logic is to move the social and economic circles towards the environmental performance circle, ideally making the 3 circles overlap. This, passing the static vision that wants to see the 3 circles fixed with only a small central area of intersection where to find the sustainability.

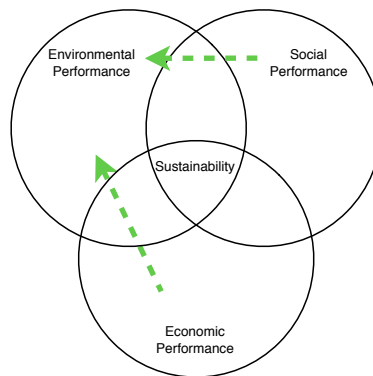


Figure 4: The triple bottom line of sustainability revisited

Figure 5 shows the framework of how the results are presented and how they are used to answer the ROs and the linked Hs.

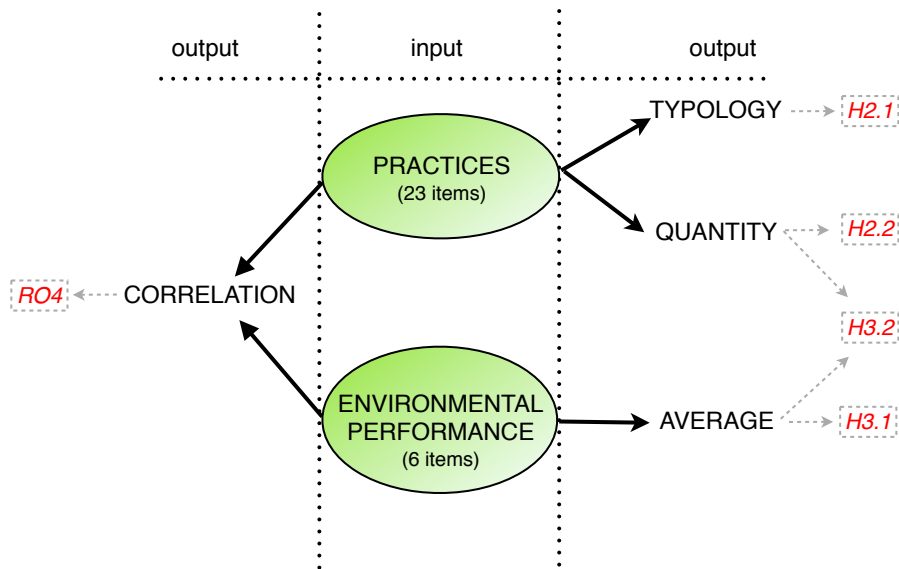


Figure 5: Framework of the analysis

In the analysis of the typology and quantity of GSCM practices adopted, have been taken into account only the ones already full implemented or at least with some activities in execution (in the 5-point Likert scale this correspond to a value of 5 and 4 respectively). This decision is consistent because, for RO3 and RO4 to be analyzed, is necessary that at least the GSCM practices are partially implemented.

To evaluate H2.1, practices have been sorted from the most to the less partially or fully implemented and are considered relevant differences between clusters of more than 2 practices out of the 5 most adopted. Hypothesis H2.2 is instead assessed through the analysis of the average of practices adopted by companies in each cluster and is considered relevant a difference of 10% or more. Table 2 is an example of how the informations are collected to answer these first 2 hypothesis.

Table 2: (excerpt of) Practices implemented based on “Company Dimension” context

practice n°	Small company (N=41)	# 4	# 5	#4-5	%4-5	%5
8	Design of products for reduced consumption of material/energy	18	10	28	68	24
10	Design of products to avoid or reduce use of hazardous products	20	7	27	66	17
20	Support for GSCM from mid-level managers	16	11	27	66	27
17	Environmental Management Systems exist	13	10	23	56	24
9	Design of products for reuse, recycle, recovery of material, component parts	18	2	20	49	5
[...]		Average =			38	11
practice n°	Medium company (N=20)	# 4	# 5	#4-5	%4-5	%5
8	Design of products for reduced consumption of material/energy	7	8	15	75	40
20	Support for GSCM from mid-level managers	9	4	13	65	20
18	Measurement and monitoring of environmental performance	9	3	12	60	15
22	Sale of scrap and used materials	8	4	12	60	20
23	Sale of excess capital equipment	8	4	12	60	20
[...]		Average =			46	16
practice n°	Medium-large company (N=20)	# 4	# 5	#4-5	%4-5	%5
8	Design of products for reduced consumption of material/energy	11	4	15	75	20
17	Environmental Management Systems exist	5	9	14	70	45
5	Cooperation with customers for cleaner production	11	2	13	65	10
9	Design of products for reuse, recycle, recovery of material, component parts	11	2	13	65	10
10	Design of products to avoid or reduce use of hazardous products	7	5	12	60	25
[...]		Average =			44	12
practice n°	Large company (N=19)	# 4	# 5	#4-5	%4-5	%5
8	Design of products for reduced consumption of material/energy	9	7	16	84	37
1	Providing design specification to suppliers that include environmental requirements for purchased items	3	12	15	79	63
16	ISO 14000 certification	2	13	15	79	68
17	Environmental Management Systems exist	2	13	15	79	68
18	Measurement and monitoring of environmental performance	5	10	15	79	53
[...]		Average =			59	23

Objective RO3 reckons on the study of descriptive statistics of environmental performance and on its comparison with informations about GSCM practices. To verify H3.1 and H3.2 has been considered the average of all environmental performance. Differences in performance between different clusters are considered relevant if there is a gap of more than 10%.

In particular to verify H3.2 the condition is that companies belonging to a cluster have implemented or partially implemented at least 10% less practices and have gained at least 10% more environmental performance compared to other clusters. In Table 3 there is an example, always for the “Company Dimension” context, of the data used to answer H3.1 and H3.2.

Table 3: (excerpt of) Environmental performance based on “Company Dimension” context

COMPANY DIMENSION		Average	Std Dev.
Small company (N=41)	[...]		
	Decrease of consumption of hazardous/harmful/toxic materials	3,39	1,202
	Decrease of frequency of environmental accidents	2,27	1,379
	Average of Environmental performance	3,053	1,0010
Medium company (N=20)	[...]		
	Decrease of frequency of environmental accidents	2,40	1,465
	Improve company's environmental situation	3,40	1,231
	Average of Environmental performance	3,025	1,0682
Medium-large company (N=20)	[...]		
	Decrease of frequency of environmental accidents	2,00	0,973
	Improve company's environmental situation	3,70	0,979
	Average of Environmental performance	3,100	0,5884
Large company (N=19)	[...]		
	Decrease of frequency of environmental accidents	2,74	1,240
	Improve company's environmental situation	3,84	0,834
	Average of Environmental performance	3,535	0,7568
Validi (listwise)			

RO4 is performed through a correlation analysis and, among significant correlations, data are highlighted as follow:

Table 4: Framework of colors used to highlight the correlations

Pearson's coefficient	Color
$x < -0,4$	negative correlated
$0,600 < x < 0,699$	well correlated
$0,700 < x < 0,799$	highly correlated
$x > 0,800$	very highly correlated

An excerpt of the correlation analysis between the 23 practices and the 6 environmental performance in the “Company Dimension” context is presented in table 5.

Table 5: (excerpt of) Correlations based on “Company Dimension” context

COMPANY DIMENSION		Reduction of air emission	Reduction of liquid wastes	Reduction of solid wastes	Decrease of consumption of hazardous/harmful toxic materials	Decrease of frequency of environmental accidents	Improve a company's environmental situation	
Small company (N=41)	Design of products to avoid or reduce use of hazardous products	Pearson Correlation Sig. (1-tailed)	.287* 0,045	.312* 0,004	0,038 0,406	.680* 0,000	.425 0,034	
	Environmental compliance and auditing programs	Pearson Correlation Sig. (1-tailed)	.577* 0,000	.496* 0,000	.467* 0,001	.387* 0,006	.272* 0,043	
	[...]							
	Cooperation with suppliers for environmental objectives	Pearson Correlation Sig. (1-tailed)	.782* 0,000	.822* 0,002	.668* 0,001	.683* 0,000	.672* 0,001	.655* 0,001
Medium company (N=20)	[...]							
	Environmental Management Systems exist	Pearson Correlation Sig. (1-tailed)	.523* 0,009	.619* 0,002	.635* 0,007	.429* 0,030	0,361 0,059	.549* 0,006
	Measurement and monitoring of environmental performance	Pearson Correlation Sig. (1-tailed)	.689* 0,001	.687* 0,000	.645* 0,001	.454* 0,022	.498* 0,013	.654* 0,001
	Design of products for reduced consumption of material/energy	Pearson Correlation Sig. (1-tailed)	0,378 0,056	0,203 0,198	.742* 0,000	0,338 0,073	0,090 0,590	-0,024 0,461
Medium-large company (N=20)	Design of products to avoid or reduce use of hazardous products	Pearson Correlation Sig. (1-tailed)	0,009 0,485	-0,306 0,095	.822* 0,009	.793* 0,000	0,150 0,264	0,010 0,483
	[...]							
	Investment recovery (sale) of excess inventories/materials	Pearson Correlation Sig. (1-tailed)	-.471* 0,016	-0,125 0,360	0,333 0,076	0,217 0,179	-0,046 0,423	0,023 0,462
	Sale of excess capital equipment	Pearson Correlation Sig. (1-tailed)	-.400* 0,040	-0,173 0,232	0,243 0,151	0,143 0,274	0,103 0,332	-0,072 0,382
Large company (N=19)	Providing design specification to suppliers that include environmental requirements for purchased items	Pearson Correlation Sig. (1-tailed)	0,319 0,092	.440* 0,030	.775* 0,000	0,226 0,176	-.242 0,159	.565* 0,006
	[...]							
	Design of products for reduced consumption of material/energy	Pearson Correlation Sig. (1-tailed)	0,281 0,146	.402* 0,044	.728* 0,000	0,279 0,124	-0,011 0,482	.597* 0,004
	Investment recovery (sale) of excess inventories/materials	Pearson Correlation Sig. (1-tailed)	0,016 0,474	-.492* 0,044	-0,295 0,118	-0,271 0,131	-0,017 0,472	-.412* 0,040
Sale of excess capital equipment	Pearson Correlation Sig. (1-tailed)	-0,024 0,462	-.834* 0,002	-0,352 0,070	-0,245 0,156	0,021 0,467	-0,387 0,051	

*. Correlation is significant at the 0.01 level (1-tailed)

**. Correlation is significant at the 0.05 level (1-tailed)

Discussion of Main Results

The analysis have been repeated for every one of the 19 contexts to find relevant ones according to the ROs.

Table 6 highlights, for each context studied, the hypothesis that have been verified, while Figure 6 compare their number pointing out the most relevant contexts.

Table 6: Validity of the four hypothesis in each context

Context \ Hypotesis	H2.1	H2.2	H3.1	H3.2
1. Company dimension	VERIFIED	VERIFIED	VERIFIED	NOT VERIFIED
2. Belonging to a group	NOT VERIFIED	VERIFIED	NOT VERIFIED	NOT VERIFIED
3. Production strategy	VERIFIED	VERIFIED	VERIFIED	VERIFIED
4. Prospective supply chain	NOT VERIFIED	NOT VERIFIED	VERIFIED	NOT VERIFIED
5. Number of supply chain served	NOT VERIFIED	NOT VERIFIED	NOT VERIFIED	NOT VERIFIED
6. Role in the supply chain	VERIFIED	VERIFIED	VERIFIED	NOT VERIFIED
7. Way of Interaction with other actors	VERIFIED	VERIFIED	VERIFIED	VERIFIED
8. Replaceability	VERIFIED	NOT VERIFIED	NOT VERIFIED	NOT VERIFIED
9. Green image pressure	NOT VERIFIED	VERIFIED	VERIFIED	NOT VERIFIED
10. Product and internal processes pressure	NOT VERIFIED	VERIFIED	VERIFIED	NOT VERIFIED
11. Non local customer pressure	NOT VERIFIED	VERIFIED	VERIFIED	NOT VERIFIED
12. Community pressure	NOT VERIFIED	VERIFIED	VERIFIED	NOT VERIFIED
13. Supply chain pressure	VERIFIED	VERIFIED	VERIFIED	NOT VERIFIED
14. Internal factors pressure	NOT VERIFIED	VERIFIED	VERIFIED	NOT VERIFIED
15. Competitors pressure	VERIFIED	NOT VERIFIED	VERIFIED	NOT VERIFIED
16. Regulatory pressure	VERIFIED	VERIFIED	VERIFIED	NOT VERIFIED
17. Company performance versus competitors'	VERIFIED	VERIFIED	VERIFIED	NOT VERIFIED
18. Supply chain performance versus competitors'	VERIFIED	NOT VERIFIED	NOT VERIFIED	NOT VERIFIED
19. Performance trend of the last 3 years versus competitors'	NOT VERIFIED	VERIFIED	VERIFIED	NOT VERIFIED

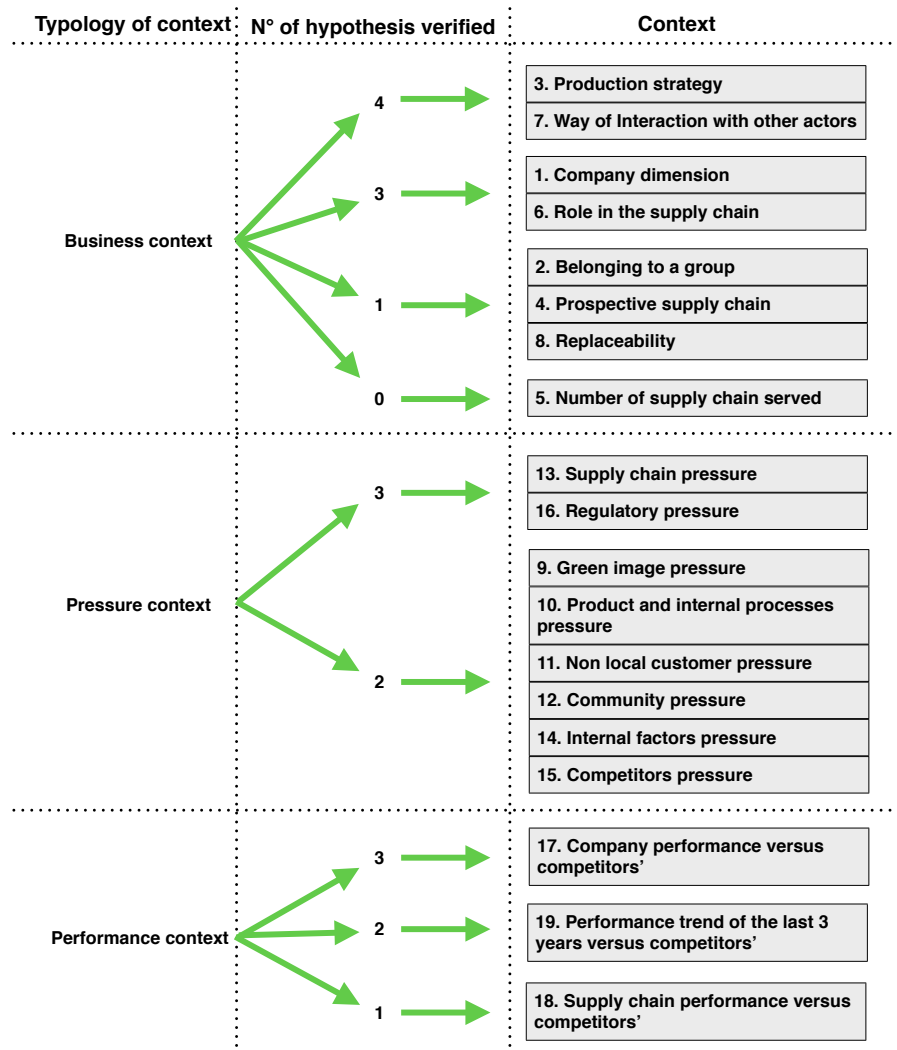


Figure 6: Summary of the n° of hypothesis verified in each context

The first overview of Table 6 shows that all the contexts studied, except for “Number of supply chain served”, divide the sample in clusters with a significative difference in GSCM practices implemented and/or environmental performance gained. This seems to justify the importance of this contingency analysis and the relevance of the contexts selected. However, the hypothesis investigated are not verified with the same frequency among the 19 contexts studied.

H3.1, i.e. companies in different context achieve different level of environmental performance, is the most verified (15 times) followed by H2.2, i.e. companies in different context apply different quantity of GSCM practices, that is verified 14 times.

H2.1, i.e. companies in different contexts apply different typology of practices, is instead verified 10 times while H3.2, i.e. in some contexts companies with lower level

of GSCM practices adoption achieve better environmental performance, is the less verified (only 2 times). Interesting to notice that in the 2 contexts in which H3.2 has been verified, all other hypothesis have been too, almost as if H3.2 would require all other hypothesis to be verified. Figure 6 is even more clear to point out that only in “Production strategy” and in “Way of interaction with other actors” contexts all the hypothesis are verified. These 2 business contexts seems to have the highest influence on GSCM practices and environmental performance. Different clusters of companies based on these 2 contexts implement different typology of practices, in a different quantity and achieve different and sometimes opposite performance, compared to what would be supposed if looking at their adoption efforts.

Starting from the “Production strategy” context, very interesting is the behavior of Innovate To Order (ITO) companies. As the ETO firms, they implement only operational practices. However the ITO firms have the lowest level of GSCM practices adoption (31%) together with the best environmental performance (3,426), significantly higher than that of MTO-ATO firms (3,076). Previous researches on GSCM, as Zhu et al. (2011), have verified that usually higher level of practices adoption leads to higher environmental performance but, for this particular cluster of companies, does not seem to be true.

Looking at the correlation analysis, ITO companies have 20 GSCM practices significantly related with environmental performance, among which there are all the 5 most implemented. Can be suggested that these firms know how to correctly apply the practices so to obtain the best improvement and that they know which are the best practices to be implemented in their context. This unpredicted result can be explained looking at the nature of ITO firms. In fact, as explained in Wadhwa and Rao (2003) in relation to the ITO firms, the future of competitiveness will involve both variety and responsiveness challenges with an increasing focus on proactive knowledge and innovation management. Considering this and the high technology of products/services the ITO companies can offer, can be plausible that these companies have the knowledge, competence and willingness to find the best practices and the right way to implement them in relation to their context. In any case ITO companies demonstrate that is possible to achieve great environmental beneficial effect without a “quantity approach” but with a “quality approach” to GSCM practices.

The “Way of interaction with other actors” context is the other one in which H3.2 is verified. In this context company receiving directions obtain significantly better performance of firms doing passive cooperation, respectively 2.972 and 2.563, and this despite a lower practice adoption. This could be explained considering that companies receiving directions do not lose any time thinking on what to do and how to properly do it but just apply the practices imposed by firms dictating directions and in the way they say it has to be done. Conversely, companies doing passive cooperation are probably

involved in an activity that they are not interested in and this could affect the overall environmental performance gained.

Always in this context is clear that the best environmental performance are obtained by companies doing peer-to-peer or active cooperation, that apply a significant more quantity of practices. This to confirm that a real involvement of the firms along the supply chain is required to obtain beneficial effects on supply chain environmental performance.

The clusters based on the “Company dimension” context show that companies with an increasing dimension tend to apply more practices and to shift their attention from operational to managerial ones. Also the environmental performance have this positive trend going from small to large firms. H2.1, H2.2 and H3.1 are so verified.

H3.2 is the only not verified and, instead, is clear that large companies obtain significant better environmental performance than all others. Looking at the correlations analysis appears that the 2 most implemented practices by large companies are also high correlated. This context confirm that the dimension of the companies and the quantity of practices implemented can have a great impact on environmental performance. This for sure is related to the different level of material, human and financial resources that large companies can exploit towards environmental objectives.

Significant also the results of the 2 clusters based on “Prospective supply chain” context. Companies with a prospective supply chain adopt quite the same practices and in the same quantity but achieve significant better performance than companies without a prospective supply chain. So it seems that in this cluster companies are able to apply in a better way the same practices. This seems to be confirmed also looking at the correlation analysis in which 10 practices show a significant positive relation with environmental performance and between them there are all the most implemented. Companies without a prospective supply chain instead have only 2 practices significantly related. The reasons of this difference could be explained considering that companies with a prospective supply chain have necessarily a proactive attitude because they are searching for new opportunities. This mentality could help them to positively apply the practices, confirming that a “quality approach” to GSCM practices can lead to significant superior results.

Regard to the contexts based on the different levels of pressure perceived by the companies, from Table 6 is possible to outline a common behavior: all the firms receiving a relevant pressure are also the ones with relevant better environmental performance. Except for “Competitor pressure” context, all other reveal also that firms with a relevant pressure apply significant more GSCM practices.

For 5 out of the 8 different types of pressure, firms receiving a relevant pressure tend to apply significant more practices achieving better environmental performance, this without changing the type of practices most adopted. This suggests that in the majority

of the cases companies respond to a pressure just applying more practices. To better interpret the data is useful to look at Table 7.

Table 7: Impact of different pressure on the sample

PRESSURE	N° of Not Relevant	N° of Relevat	Increase in environmental performance
12. Community	84	16	35%
15. Competitors	79	21	15%
14. Internal factors	61	39	36%
10. Product and internal processes	60	40	24%
13. Supply chain	55	45	33%
9. Green image	45	55	26%
11. Non local customers	44	56	18%
16. Regulatory	9	91	27%

From Table 7 results that the distribution of the sample, varying the type of pressure, is not always the same. In only 3 pressure, out of the 8, there are more companies receiving a relevant pressure. These pressure are: “Green image”, “Non local customer” and “Regulatory”. At the extreme there are “Community” and “Regulatory” pressure. Considering “Community” pressure 84 firms do not receive a relevant pressure, while instead 91 firms receive a relevant “Regulatory” pressure.

Looking at the increase in environmental performance derived from a relevant pressure the values go from a 15% of companies receiving a relevant “Competitors” pressure to the 36% of companies receiving an “Internal factors” pressure. “Regulatory” pressure, that is without doubt the more widespread among the firms, stops at 27%.

Interesting the result of the 16 firms receiving a relevant “Community” pressure that achieve a 35% increase in environmental performance. Looking at the quantity of practices implemented they do significantly more and are the only ones to achieve an average of all environmental performance above 4,00 (4,042). This is achieved through very high values in “Reduction of air emission” (4,50), “Reduction of liquid wastes” (4,06), “Decrease of consumption of hazardous/harmful/toxic materials” (4,19) and “Improve company’s environmental situation” (4,50).

Looking at the correlations analysis, in this case the results are quite different from what expected. In fact only in “Decrease of consumption of hazardous/harmful/toxic materials” there are GSCM practices significantly related. Can suppose that in this case no practices are significantly related with the other single environmental performance but the high beneficial effects on environmental performance for this case derive more from the quantity of practices implemented as a whole.

The “Regulatory pressure” context reveals that the 9 companies do not receiving a relevant pressure are the less active with an average of only 17% of practices adopted. It seems so that this cluster of companies is the less stimulated to adopt GSCM practices.

In this context, besides H2.2 and H3.1, H2.1 is also verified and this can be justified considering that regulatory pressure often forces firms to apply specific practices, different from what they would have applied by their own.

In the last 3 contexts based on the perceived level of performance compared to competitors’, in particular has been assessed the perceived performance of the companies, of their supply chain and the trend in the last 3 years. The results visible in Table 6 show that there is not a similarity, concerning the hypothesis verified, between these 3 contexts. The only similarity is in the distribution of the sample between the 3 clusters in each context, with always very few companies perceiving a poorer performance. This can be explained with the consideration that the answers to this survey could have arrived principally from companies with an interest in GSCM issues and with a positive consideration of their overall performance compared to competitors’. The “Performance of supply chain versus competitors” context shows some contradictions because, despite the performance perceived, companies with poorer performance show slight better values of the average of all environmental performance. This difference is however not enough to be considered relevant but show some discrepancy between the perceived performance of the supply chain and the environmental performance of the company. Would be interesting to explore through further researches the reasons of this result.

Conclusions

This paper has had the aim to apply the contingency theory to GSCM and, through a contingency approach, to study the impact of different contexts on GSCM practices implemented and environmental performance gained. Many contexts have been demonstrated to be relevant, affecting in a significative way behaviors and outcomes of the firms. Correlation analysis, through an evaluation of relationships between practices and performance, have helped to justify differences between different contexts and clusters. In 2 clusters has also been verified that companies adopting fewer practices manage to obtain better environmental performance than other clusters, and this despite many research often conclude that adopting more generally lead to better performance (e.g., Zhu *et al.*, 2011).

The results of this paper so confirm that a contingency approach to GSCM is useful to not lose the unicity of the contexts in which companies operate and to give them the right advices regarding the best practices to adopt, so to achieve greater sustainability.

The fact that all data comes from Italian companies is the major limitation of this paper, because results could differ in other countries. Also the dimension of the sample is

another limitation because in few cases this leads to clusters of less than 10 companies. However the research methodology applied and the main results are not affected by this, but further analysis with a bigger sample size could be appreciated to confirm these results. Further research also could, through case studies, focus on the most interesting clusters of companies, so to continue with the explanation of the most interesting results obtained in this paper.

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