Developing a green supplier maturity model: Concepts, application and limits

Joe Miemczyk, Thomas Johnsen, Emmanuelle Bernardin

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Joe Miemczyk*
Thomas Johnsen
Emmanuelle Bernardin
Audencia Nantes School of Management
8, Route de la Joneliere, 44312 Nantes
France
jmiemczyk@audencia.com, ebernardin@audencia.com, tjohnsen@audencia.com

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Summary

The purpose of this paper is to review the literature stage models in purchasing and supply, and environmental management, to develop a model of 'green' supplier management. Starts with a discussion of current thinking on models of supplier assessment and development, particularly in the field of environmental performance. Thinking behind maturity models, especially as applied in purchasing, supply and green performance, is then treated. The applicability of combining green and supply maturity models is then described. The paper finishes with some comments on limits of maturity models in this field and their applicability.

Introduction

Environmental or green performance continues to be one of the significant issues facing purchasing organisation today. Legislation that limits the types of product inputs, aims to facilitate product recycling, minimises pollution and waste from production processes and controls the effects of transport and logistics networks – are among a whole raft of policies that influence decisions businesses make. Current challenges include reducing the carbon footprint of whole industries, where trading of emissions is seen as one way of balancing the needs of industry and society more equally. One opportunity for influencing the action of firms is through supply chain relationships. While companies are directly influenced by legislation, they are often more directly driven by customer requirements. Hence, if those requirements include green targets it can be reasonably be assumed that such goals would form elements of decisions taken by supplying organisations and contribute to green performance. Clearly not all suppliers will be at the same level of performance and hence targets need to be set that reflect this. In addition, it is well documented that green performance is related to certain organisational attributes, so that firms that display certain characteristics are likely to be better performers, perhaps exhibiting less risk, than others (Fischer and Schot 1993; Welford 1995).

This paper starts from the point of view that firms' organisational characteristics differ in relation to their green activities and that this influences their performance. The argument also follows that much of this green activity is driven by customer influence, bringing a customer relationship element into the development of green strategies of firms (Carter et al. 1998). From this it follows that combining thinking on the development of green strategies within firms and strategies for purchasing and supply provides a useful perspective on how companies can view the capabilities of their suppliers to respond to the increasing influence of

* Corresponding author

the environment. An important concept here is maturity, whereby firms that display certain characteristics are more able to respond to more challenging targets. There are many models of maturity in the environmental strategy field, and this is also reflected in the purchasing and supply domain, but these have not been viewed together in order to help evaluate suppliers capabilities. While there have been attempts to apply this thinking to purchasers (Bowen et al. 2001a), there is also utility in applying these ideas to the other side of the relationship, i.e the supplier side.

Background literature

Relatively little has been written on how supplier environmental activities and performance evolves as a result of buying companies initiatives in this area. Examining a firm's evolution naturally links to thinking on maturity models, which are regularly featured in management literature. While there are examples of maturity models for purchasing organisations (eg Reck and Long 1988), there is little evidence of these models being explicitly applied to the supply base itself. However, looking at the supplier development and assessment literature there is ample research showing that customers measure their suppliers' performance over time, categorise them and initiate actions to help suppliers achieve expected levels of performance. We argue that this activity maps well onto maturity model thinking and that bringing these literatures together is of value. Furthermore the application of these two literatures to the field of suppliers' green activity is also novel and is useful in the development of theory and practical insights.

Supplier assessment and development

The assessment of suppliers along various lines of performance is a well researched field (Baiman et al. 2001; Harrington et al. 1991; Ruamsook et al. 2007). Assessment criteria typically include a combination of externally focused measures linked to competitive priorities, such as quality, delivery, price, service and flexibility, and internally focused measures such as defects, schedule realisation and cost (Venkatraman and Ramanujam 1986; Prahinski and Benton 2004). Internal process-based supplier assessment criteria enable companies to better understand the supplier's process capabilities and this creates a rationale for the formation of supplier development programmes. Supplier assessment is therefore a natural precursor for successful supplier development programmes (Modi and Mabert 2007; Prahinski and Benton ibid), and there is clear evidence of a positive relationship between the two (Dyer 1996; Hines 1994). Supplier development programmes aim to improve supplier performance and capabilities by diffusing manufacturing and production expertise throughout the supply base (Modi and Mabert 2007). In practice, supplier development programmes often involve engineer visits, in-supplier improvement workshops, dedicated teams and personnel allocated to supplier skill development (Krause et al. 2007; Rogers et al. 2007).

There is some evidence to suggest that supplier assessment schemes increasingly include measures of suppliers' environmental, ethical, health and safety, and social standards (Waddock and Smith 2000). Indeed, outsourcing to low-cost countries increases the need to integrate corporate social responsibility (CSR) into supplier development programmes both for legal and voluntary reputational reasons (Kortelainen, 2008; Walker et al 2008). Environmental or green practices form a key part of CSR, which has become a strategic challenge for all organisations.

Research on green activities within the supply base has primarily focused on drivers, measures of performance, categorisation of green supply strategies and links to the buying companies' capabilities (Beamon 1999; Bowen et al. 2001b; Green et al. 1998; McIntyre et al.

1998; Rao and Holt 2005). However, suppliers are frequently assessed on their environmental performance as one of many assessment criteria (Carter et al. 1998; Preuss 2005), although often low down the list of decision priorities (Grankvist and Biel 2007). What is less understood is the supplier development activity in this area and how it impact on suppliers' green performance. Certainly approaches will vary from industry to industry, but there is some evidence that that companies may integrate 'green' improvement activities with suppliers in their supplier development strategies, as is the case of Unipart in the UK (Handfield et al. 2005). The focus of supplier evaluation for environmental related reasons tends to be on the measures of specific physical parameters which is useful but is very specific to the industry and the strategic objectives of the suppliers and potentially their markets. Hence, there is also utility in assessing suppliers on their relative sophistication, or maturity, in more organisational or process oriented measures. While most firms focus on environmental system adopted (eg ISO14001), there are other aspects which could be viewed as useful in judging likely performance or risk. Again the case of Unipart highlights a range of organisational measures aimed at judging a supplier's level of engagement in environmental systems, ranging from 'not demonstrating compliance' to 'certification to ISO14001 or EMAS' . However, this scale does not include some measures of proactive environmental management found in other models and the path to achieving the top score is not necessarily step-wise (and supplier may jump stages).

Models: stages and maturity

Looking at both the supply and environmental strategy literatures reveals a wealth of models typically allocating practice to stages or levels of maturity. The following outlines some of the key models.

Models of supply maturity

There have been many models of supply (purchasing) management maturity proposed in the past, often stemming from other works such as that from Hayes and Wheelwright (1984). One theme is that the stages of maturity appear to be path dependent in the sense that jumping steps can be problematic (Reck and Long 1988). Schiele (2007) has provided a well-grounded review of supply maturity models covering the scope of the main models (no. of stages, no. of assessment items, planning, structure, process, human resources, control and collaboration). Key milestones in the development of these models include environmental scanning (Burt and Doyle 1994), the visibility and strategic level of purchasing (Reck and Long, Cousins et al 2006) and so on. The important link to performance, while mentioned by all studies into supply maturity, is not always tested.

	Stages or levels			
Reck and Long 1992	*Passive* • No strategic direction • Quick fix • Routine	*Independent* •Latest techniques •Independent strat •Cost/efficiency	*Supportive* • Suppliers resource • Monitoring • Analysis	*Integrative* • Strategic • Cross functional • Developed capabilities
Freeman	*Buying* • Basic financial planning	*Purchasing* • Forecast based planning	Procurement • External oriented planning	Supply • Strategic management
Cammish & Keough	Serve the factory • Clerical • Basic logistics	Lowest Unit cost • BU level • Analysis • Negotiation	Coordinate purchasing • Centralised • Corp policy	Strategic procurement • Cross-functional • Certification • Development
Burt and Doyle	Reactive	Mechanical	Proactive	Strategic Supply

Paulraj et al 2007	Nascent • Less important than other functions • Short term • Cost based	Tactical • Strategy formulation • Key contributor • High visibility		Strategic • Integrating supply base • Strategic collaboration
Cousins et al 2006	Undeveloped • Low planning, status and integration	Celebrity • High status • Low knowledge and skill	Capable • Professional • Skilled • Low links to overall performance	Strategic • Aligned with strategy • SCM focus, not contracts • Relationship management
Syson	Clerical	Commercial		Strategic
Kraljic 1984	Purchasing	Materials management	Sourcing management	Supply management

Table 1: Comparison of selected purchasing/supply stage models

It is important to understand how each model is operationalised, in order to apply these models and/or perhaps select appropriate elements of each model to develop a novel application. Examining the main dimensions used to define each stage it is possible to find commonality between the models. The following table details the main dimensions used and their related elements (detail of how each is defined).

Dimension	**Elements**	**References (examples)**
Organisational structure	Degree of : Hierarchical status, visibility, cross functionality, teams based organisation, participation at board level	(Reck and Long 1988)
Processes	Sophistication of: Supplier selection, evaluation, & development (training), internal collaboration	(Cousins et al. 2006)
Technology	Degree to which IT support helps the other dimensions	(Paulraj and Chen 2007)
Control	Level of: Performance measurement, tools and procedures	(Reck and Long 1988)
Collaboration	Range between: Confrontation to partnership,	(Burt and Doyle 1994)
Human resources	Level of: Professionalism, skill levels (including technical), recruitment, integration and appraisal	(Kraljic 1983)
Planning	Level of: planning of specifications, analysis of markets and technology or scanning of the environment	(Paulraj and Chen 2007)

Table 2: Dimensions of purchasing/supply stage models

The focus of this paper is to understand supplier maturity, in the context of the buying organisation. With this in mind we assume that the supplier maturity (ie the company's role as a supplier) reflects similar dimensions as purchasing or supply maturity. This is because much of the supplier's role is relational, as is purchasing, and so we can explore this almost as the mirror of the purchasing dimensions. No doubt the link between purchasing and performance is linked to performance of suppliers themselves, and so both sides of a relationship needs to be understood. This rationale has been developed in supplier assessment and evaluation models in previous research (Johnsen et al. 2008).

Models of ' green' maturity

Stage models of corporate 'greening' have also received much attention over the last 2 decades (Roome 1992; Schaefer and Harvey 1998; Shuangyu Xie 2007). Two of the first and most cited examples of green maturity in general are those developed by Hunt and Auster (1990) who describe 5 steps from beginner (1) through to proactivist (5), and Roome (1992)

describing non compliance (1) to excellence (4). These have since been modified and added to, but still remain the most widely cited.

Roome's (1992) model of corporate strategic response to environmental issues is one of the more comprehensively defined. He distinguishes between five strategic options ('non-compliance', 'compliance', 'complianceplus', 'commercial and environmental excellence' and 'leading edge'). The first four are conceived as stages on a developmental continuum whereas the fifth option defines the environmental leaders for a given industry, regardless of their position on the 'non-compliance' to 'excellence' continuum. Hunt and Auster (1990).
Like Roome (1992) they conceive of five stages on the route to environmental excellence: 'beginner', 'fire fighter', 'concerned citizen', 'pragmatist' and 'pro-activist'. They define these stages in terms of risk reduction, commitment and programme design, with a number of sub-criteria. There are also a number of less cited examples of stage models of green maturity. Newman and Breeden(1992) suggests three stages: 'reactive', 'pro-active' and 'innovative'. The individual stages are not well defined but they broadly represent a company's attitude to environmental risk and opportunity. Winsemius and Guntram (1992) conceive of four stages in corporate environmental response: 'reactive', 'receptive', 'constructive' and 'proactive'. They define them in terms of integration of business functions, co-operation of people and organizations and generation of new ideas and concepts. Greeno (1991) describes three stages defined in terms of primary purpose, primary motivations and vulnerability of environmental management.

	Stages or levels				
Roome 1992	Non compliance • Competing objectives • Cost constraints	Compliance • Stakeholder analysis • Clean tech • Auditing	Compliance plus • Beyond current legal • New structures • Integ. to strategy	Excellence • Corp values • Decent resp • Stewardship • Cust led	
Hunt and Auster 1990	Beginner • Casual reporting • Add-on resp	Fire fighter • Central staff • Crisis mgt • Not priority	Concerned citizen • Tech competence • Low influence • Verbal commitments • Low integration	Pragmatist • Risk aval • Policy invest • Edu / training • Reporting • Expertise & funds • Limited visibility	Pro-activist • High profile • Systems • Integration • High awareness • Effective interfaces • Stakeholder info sharing
Newman 1993	Reactive • Respond to risk	Proactive • Manage risk • Identify opportunities	Innovative • Minimise risks • Maximise opportunities		
Winsemius & Guntram 1992	Reactive • Separate function • Internal view	Receptive • Higher status • Internal cooperation	Constructive • Aligned functions • Internal cooperation • New ideas internally	Proactive • Integrated of functions • Cooperation outside of the firm • New ideas internal and external	
Greeno 1991	Problem solving • Identifying and quantifying • Corrective actions	Managing for compliance • Meeting regulation • Meeting standards	Managing for assurance • Certification • External approval		

Table 3: Comparison of selected 'green' stage models

Yet later research suggests that these models are overly simplistic and difficult to apply in practice, mainly because of their prescriptive, normative intention as opposed to empirical bases (Hass 1996; Schaefer and Harvey 1998). Hence, research suggests that the use of these models primarily depends on the use for which they were designed. As the design of these models tends not to be driven by a supply performance perspective, there is opportunity here to explore whether a supply oriented model is useful in a supply context. The following table outlines the key dimensions used to categorise a firms 'level' with respect to environmental strategy or response.

Dimension	Elements	References (examples)
Strategy / Policy	From no strategy/policy, or competing priorities to anticipatory, systems view	(Hunt and Auster 1990)
Structure	Ranging from no change to integrated, decentralised, flexible matrix structures	(Winsemius & Guntram 1992)
Integration	Links between corporate and business unit levels, trust, information sharing	(Winsemius & Guntram 1992)
Human resources	Degree of awareness and training, part of staff development, responsibilities at each function	(Roome 1992)
Leadership	No support to top management support, links to core corporate values	(Hunt and Auster 1990)
External links	Stakeholder mapping, cooperative problem solving, working with regulators	(Roome 1992)
Process / programmes	From reducing liabilities/crisis management to product stewardship, clear goals and auditing	(Greeno 1991)

Table 4: Dimensions of environmental stage-based (maturity) models

Assessing and developing a supplier's green maturity

Thus examining the literature on supplier assessment, development, stage models and maturity indicates that the links between development and performance in the area of green activities is an emerging area. It is clear that customers measure their suppliers environmental performance and may suggest some measures to improve the level of performance. One example is that of Unipart in the UK. In developing its 'Ten to Zero' programme included a set of performance levels relating to environmental performance, with zero aiming at zero impacts (of course unattainable in reality). While certain actions were implemented to help suppliers, such as information briefings in adoption of ISO14001, these efforts were limited. Yet examples of this type of practice are mainly anecdotal. In order to develop suppliers' green maturity (assuming this is an objective of firms), it is clear that looking only at supply maturity models or green strategy stage models will be a limited exercise both because of the intentions of each approach and that each fails to address the specificities of the other's purpose. While supply models tend to focus on purchasing organisations, an important element is the level of strategic visibility and the level of interaction or joint activity between buyers and suppliers. This then forms a major 'common' component in the development of a green supplier maturity model.

Hence it is proposed to examine the combination of supply and green stage models. The approach is to select those dimensions which are common across the supply and environmental maturity models, i.e. those that focus primarily on the relational (external, and relationship supporting) aspects of companies in a supplying context.

	Levels		
Structure	Low visibility, separate function	⟷	Integrated, matrix approach

Human resources	Awareness training	⟷	Function responsibilities
Strategy and leadership	No links	⟷	Part of corp values, board level rep.
External collaboration	Confrontation	⟷	Partnerships with key stakeholders
Process	Focus on supply risk	⟷	Full LCA and eco-design
Planning	Specification checks	⟷	Market, legislation scanning
Control	No measurement	⟷	EMS and PMS linked

Table 5: Initial model of green supplier maturity

The following section develops some of the dimensions of green supplier maturity. The first important element links to the structures in place to support green strategies. Firms that have relatively low visibility and little internal integration of the environment related functions may be expected to respond less completely compared to suppliers with a greater level of integration and perhaps a more matrix oriented structure in relation to responsibilities. Linked to this would be the alignment of human resources which would range from only providing awareness training through to detailing full responsibilities at each functional level. As most research suggests, any strategic endeavour requires top management support and leadership, hence more mature firms would be expected to exhibit a greater level of integration of green imperatives into the corporate values of the firm and even responsibilities at the board level. An important element of the relational aspect of this model is the dimension relating to external collaboration. This dimension would be viewed more broadly than just buyer-supplier relationship, but also include further links to a wider representation of stakeholders deemed important to the green imperatives the firm considers. This dimension would vary according to the established levels of collaboration ranging from confrontational to fully collaborative with a range of stakeholders. Models in both areas of green and supply maturity consider process elements. This could be viewed in relation to increasing sophistication of processes from only focusing on risk management through to complete life cycle analysis and links into the product or service design process. Linking back to the focus on risks, the planning dimension would start with checks on customer specifications through to broader market and policy scanning in order to pre-empt new developments and put in place proactive strategies to capitalise on opportunities (first mover type advantages) and minimise threats on licence to operate. The control element again ranges in terms of sophistication particularly related to measurement systems and extends into full integration of environmental management systems into the firm's performance measurement systems.

Clearly each of these dimensions required a precise and detailed description which cannot be described here, in order to be operationalised by companies. Furthermore the initial model is based on a theoretical combination of literatures, which logically appears to be useful. However, the next stage of testing would be required in order to validate the dimensions and their constituent measures and their practical use.

Conclusions, limits and further research

This paper has attempted to review and combine two literatures (environmental strategy and purchasing and supply stage models) in order to develop a new model of green supplier

maturity. There are many elements of these models that are either the same or complementary so that a combination of the two sets appears feasible in the first instance, although the important testing phase is still to be completed. In particular, those dimensions that are specifically relational are viewed as important in the developed model.

As many of the critical studies of maturity models have shown there are numerous pitfalls in the operationalisation of the model. The first and main criticism is the assumption that firms can direct strategy from above in a prescriptive and rational manner so there is a logical flow through stages of development. As the example from Unipart shows, existing models often ignore the fact that companies could jump levels, and perhaps miss crucial stages in development. The model developed here is based on a combination of models, many of which have already been tested, and have sought to avoid some of these issues.

The second assumption, specific to supply (or network) management is that suppliers can be influenced (developed) to move through a set of prescribed levels. The central idea in this paper is that purchasing organisations require their suppliers to respond to their demands and requirements, and depending on their maturity level suppliers would be better or worse equipped to cope with these demands. If suppliers do not meet expectations their may be an expectation that customers could influence firms to move up the maturity 'ladder'. This is a big assumption however, and many suppliers may simply not be willing or able to do this. Further, buyers that exercise low levels of power over their suppliers could not be expected to do this.

This is an initial development of a green supplier maturity model which still needs to be tested and validated. The exact measures which could be used by a company may differ from industry to industry according to its specificities. Thus an important stage is to develop these measures and test them in a range of industries to evaluate their applicability. A second point is that the intention here is to develop a practical model that can be used. While the model is based on established theoretical contribution, it is not intended to be a research instrument (although this could be a use). Thus, for companies to use such a model it needs to be implementable. An overly complex, difficult to understand and use model is unlikely to adopted. This next stage, then would need to consider a balance between comprehensiveness and efficiency, as well as the fit with other assessment and development tools.

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