

How capabilities in Operations can influence “Green Production”

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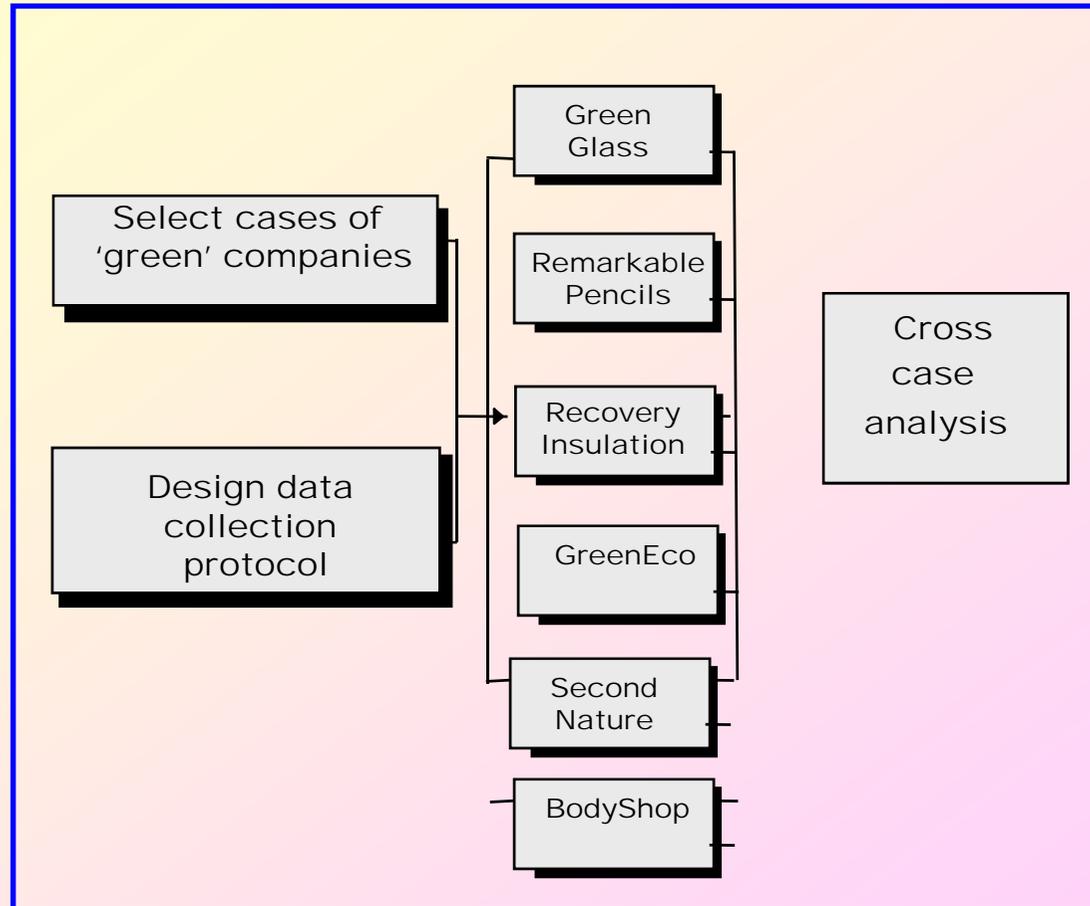
Question

'what are the production centred issues that can impact the growth of UK based green manufacturers?'

Research Objectives to be addressed are:

1. Identify and gain access to a small and representative study group of ambitious and leading green producers.
2. For this study group, explore the production centred factors that may inhibit their ability to develop as green producers.
3. Compare and contrast the findings from practice to the wider literature base to establish gaps in knowledge and areas for further study.

Exploratory studies



Literature review to inform primary research

The Literature

- The term 'green' is now widely used, although its origins lie more in the popular press than the scientific community. Increasingly, the term is seen to embrace the more established 'sustainability' literature, and so this means taking a holistic view of environmental, social and economic impact (e.g. Dobers and Wolff, 2000; Saha and Darton, 2005; Rahimifard and Clegg, 2007). The underpinning assumption is that financial success can be made consistent with an ethical, environment and society compliance (Dobers and Wolff, 2000).

The Literature

Green production is rapidly growing in importance (Brandt, 2007; Dills and Stone, 2007). As populations grow, and emerging economies expand, the planet's ecosystems and resources are experiencing tremendous challenges. For example, as countries such as China enjoy the benefits of lifestyles close to those of the western societies, the impact of human activities is estimated to rise ten-fold by 2050 (Lisney et al., 2003). At the same time, the impact of climate is being witnessed in meteorological events such as hurricane Katrina in 2005 (Rahimifard and Clegg, 2007). Clearly, urgent measures need to be taken to achieve a pivotal change in the way society in general, and industry in particular, manage natural resources (Brandt, 2007).

The Literature

- On closer inspection it is clear that the body of literature on green production is growing, but that the extent to which production operations have been studied is limited. This situation has been apparent for a little while. In 2001, Dangayach & Deshmukh recognised the relatively infantile nature of environmental matters in the mainstream manufacturing and operations strategy research and argued for more studies in this area. Yet in October 2007, Rahimifard and Clegg, in their editorial of the special issue on sustainable design and manufacture for the International Journal of Production Research, concluded that there is an urgent and imperative need for further research in every phase of a product's life-cycle. There is little to indicate that the challenges particular to production operations are any exception.

The Literature

- To guide the literature review process it has been necessary to translate the aim into a series of *research* questions. Here, it is important to emphasize that these questions have been generated by the research team to initially *seed* the literature review process and elicit relevant knowledge (see Baines et al, 2007,2008 and 2009 for a further illustration of this process). These questions were used to generally guide the identification and screening of the literature, and consisted of:
 - 1) *What is the meaning of ‘green’ production, and how does it relate to the other associated terminology?*
 - 2) *How does green production differ from conventional ways of doing business, and what are the consequences?*
 - 3) *Where are the leading examples of green production practice?*
 - 4) *What are the motives and hurdles of adopting green production, and where are the challenges to address in the future of its development?*

The Literature

Hart (1995; 1997) and Porter and van der Linde (1995) can be considered as seminal authors in the field, with also Kelindorfen et al. (1995), Azzone, Bertelè and Noci (1997, 1998, 1998) and Srivastava (2007) making large contributions.

In general, authors publishing green production have been from the USA or the UK. A few relevant papers have also emerged from other European countries, especially Italy (e.g. Azzone and Bertelè, 1994; Azzone et al., 1997a; Azzone et al., 1997b; Azzone and Noci, 1998a; Azzone and Noci, 1998b) and Germany (e.g. Seuring, 2004; Seliger et al., 2008).

In addition, recent years have seen increasing contributions from Asian countries, including China (e.g. Hui et al., 2002; Lu et al., 2007), Taiwan (Chiang and Tseng, 2005; Lee, 2008) and India (e.g. Sangwan, 2006; Srivastava, 2007).

The Literature

Intriguingly, some of the most relevant articles discussing the principles, perspectives, and challenges of green production have appeared on general interest titles, such as the Harvard Business Review (e.g. Porter and van der Linde, 1995; Hart, 1997; Reinhardt, 1999; Kleiner, 2000), the Academy of Management Review (e.g. Hart, 1995) or the International Journal of Operations and Production Management (e.g. Gupta, 1995; Azzone and Noci, 1998; Jiménez J. and Lorente, 2001).

The Literature

These concepts address, themselves, specific forms of production, namely:

Environmentally-conscious: Industrial companies make themselves committed with slowing down the degradation of the natural resources and the planet's ecosystems.

Ethical: Business enterprises take responsibility for the rights of the workers in their supply chains according to specific labour standards or codes of practice (e.g. Ethical Trading Initiative code in the UK).

Fair-trade: Buyers accept to pay prices above market levels for products of disadvantaged or marginalised producers, typically from the Third World, when these products are provided with the fair-trade label.

Organic: Food manufacturers or producers of certain non-food items, such as health and beauty products or textiles, obtain a certification from an entitled organization, (e.g. in the UK, the Department for Environment, Food and Rural Affairs, the Organic Soil Association, the Organic Food Federation) meaning that their products are made from a balanced living soil.

The Literature

Rankings are now available that list such companies and reflect their relative performance. These include the 'Dow Jones Sustainability Group Indexes' (url) which aims at enabling a more transparent assessment of sustainability driven companies on the financial market (Dobers and Wolff, 2000), 'The global 100 most sustainable corporations' (url) project which each year releases the list of the top 100 corporations in the world based on specialist evaluation of achievements on social, environmental, and strategic governance issues, the 'Global Reporting Initiative' (url) which develops and disseminates globally applicable guidelines for sustainability reporting, and the 'Climate Counts Company Scorecard' (url) which uses 22 criteria to determine companies' individual contribution to stop climate change. Similarly, green organisations and most major newspapers a range of publications, such including 'The Sunday Times', 'Business Week', and 'The Independent' in the UK, all propose their own lists of top green companies

The Literature

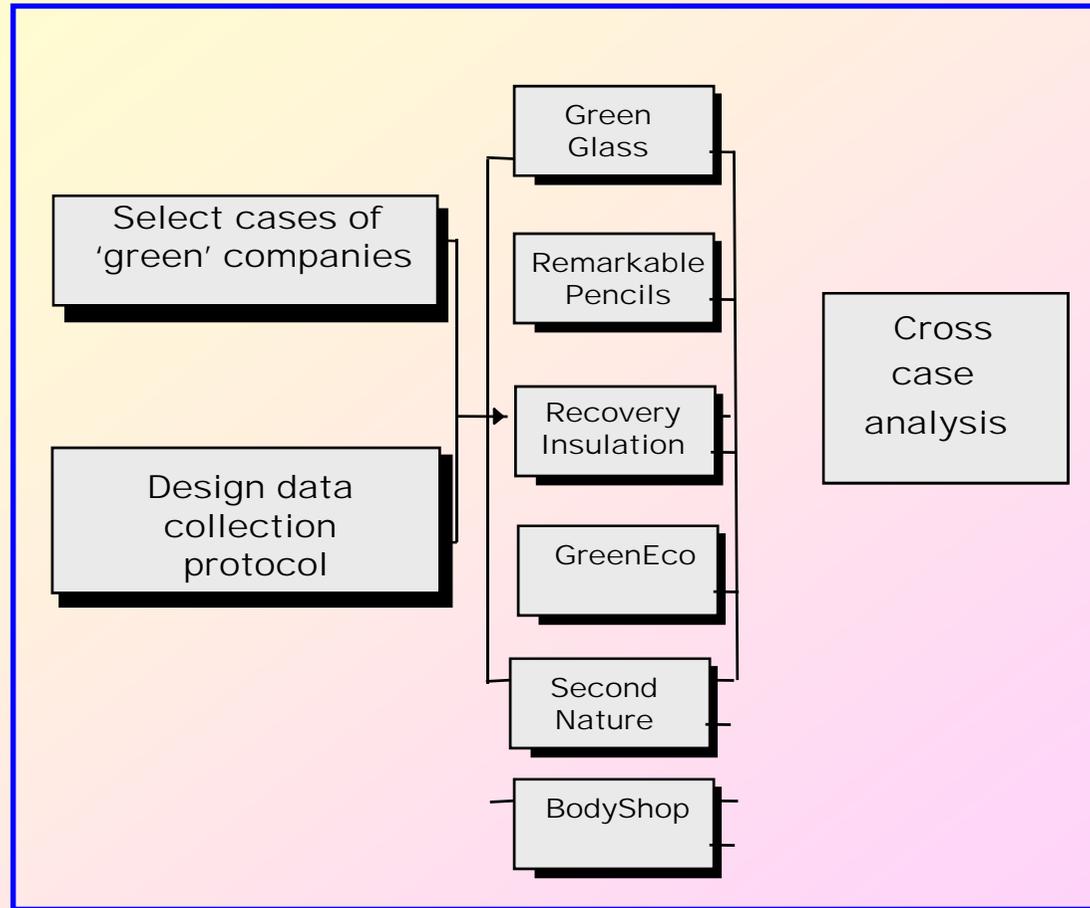
Such rankings, however, use different criteria to judge the green credentials of a business, and different methods to judge how well these are being realised in practice. For example, most leading companies have included a commitment to social concerns into their green strategies. Popular examples are Coca Cola, 3M and BMW. Working in collaboration with its largest bottling partners, Coca Cola has developed a plan for sustainability which involves its global production, marketing and distribution systems, while 3M and BMW are recognised as leaders in green management with their pre-emptive strategies that have influenced overall industry sectors.

The Literature

- Many businesses are keen to promote some Green credentials. However, realisation of these goals does not affect companies equally; rather it depends upon the extent of their Green aspirations. Here, Azzone and Noci (1998) suggest that there are five strategic Green alternatives, these being:
- *Evangelist strategy*: Ethical objectives and implying a radical approach to environmental issues.
- *Proactive green strategy*: Anticipating competitive pressures and implementing systematic initiatives throughout the whole supply chain.
- *Responsive strategy*: Largely sees the environment as a technical issue which can still be used to gain competitive advantage.
- *Reactive strategy*: Company aims to comply with environmental regulations or customers' environmental requirements
- *Unresponsive behaviour*: A passive pattern of environmental behaviour and trying to delay adoption of green programmes.

Author	Definition
Melnyk and Smith, 1996	A system that integrates product and process design issues with issues of manufacturing planning and control in such a manner as to identify, quantify, assess, and manage the flow of environmental waste with the goal of reducing and ultimately minimizing environmental impact while also trying to maximize resource efficiency
Jun, 1999	The manufacturing aiming at the symbiosis with the global environment
Yang et al., 2003	An advanced manufacturing model to realize the sustainable development of industries
Sangwan, 2006	The intersection of product development and manufacturing practices with environmental issues and concerns
Chien and Shin, 2007 Tan et al., 2002	A manufacturing mode designed to minimize the environmental impact in the manufacturing processes of products
Hua et al., 2005	The application of sustainable science to the manufacturing industry
Liu et al., 2005_a Yang et al., 2003	A modern manufacturing mode considering both the environmental impact and the resource consumption during the whole product life cycle, from design, fabrication, packaging, transportation, usage, recycling, to waste disposal, and its objective is to minimise the negative environmental impacts and maximise the utilization rate of resource, and harmonize optimization of economic benefit and social benefit with the maximum integrated benefit
Liu et al., 2005_b	The embodiment of the sustainable development strategy and the cycle economy mode in modern manufacturing
Polcari, 2007	Making a comprehensive commitment to environmentally benign practices across the spectrum of the manufacturing process
Sutor, 2007	Reducing or eliminating any negative impact on the environment by a company's facilities
Industrial Engineer, 2007	The design and commercialization of processes and products that are feasible and economical while minimizing pollution generation at the source and risk to human health and the environment
He et al., 2007	A modern manufacturing mode that takes into consideration resource consumption and the environmental impact

Exploratory studies



Literature review to inform primary research

Risk of adopting immature / bespoke technologies that demand specialist support

Process & Technology

- § Intend to use technologies that fulfil production demands but with minimal energy and material wastage.

Risk adopting immature / bespoke technologies that demand specialist support

Capacity

- § Intend to balance supply and demand to meet green credentials

Risk adopting immature / bespoke technologies that demand specialist support with capacity largely affected by materials supply over which they have little strategic power.

Facilities

- Intend to locate facilities close to markets and suppliers to minimise distances travelled by materials.

Risk being situated in locations with high labour costs.

Vertical Integration

- Intend to use suppliers with matching environmental and ethical values and practices (General trends away from vertical integration to buyer/supplier relationships).

Risk of being forced to vertically integrate if suppliers can't be found with viable green credentials

Risk

Planning & Control

- § Intend to plan and control supply and production of naturally (maybe seasonal) occurring and/or recycled materials.

Risk erratic supply because of lack of power within the supply chain coupled with what are often unprofessional in-house systems.

Human Resources

- § Intend is to support ethical employment practices and work-life balance of employees. Create local employment opportunities and equip personnel to understand green issues.

Risk higher employment costs and control of resource availability locally coupled with the tension brought about by outsourcing to local areas (in then name of reducing carbon foot print) might lead to possible ethical issues with HR practices.

Quality Control

- § Intend is to avoid rejecting materials as waste.

Risk relaxed specifications and allowing substandard product into the supply chain

Product / service range

- § Intend to only produce products that are consistent with the organisations green credentials.

Risk becoming overall dependent on a narrow range of revenue streams

Risk register

New product / service Introduction

- § Intend to thoroughly engage with 'green agenda' and directly support this through product innovation.

Risk self perception 'the way we do things around here' coupled with the lack of breadth of skills inhibits their ability to scan for further opportunities within markets and operations.

Performance Measurement

- § Intend to use environmental and social metrics in addition to financial measures.

Risks of overly focusing on ethical issues maybe at the expense of persuing world class practices in operations which ironically support the green agenda.

Supplier relations

- § Intend to use natural and/or recycled materials. (see VI above)

Risks volatility in material availability and variation in quality of supply.

Customer relations

- § Intention to sell to customers who are ethically and environmentally aware.

Risks of producing standard products in market segments where perceptions vary enormously.