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LONG TERM SUSTAINABLE PRODUCT DEVELOPMENT IN THE PACKAGING SECTOR

Thomas Woods

Northumbria University
School of Computing Engineering &
Information Sciences
Ellison Building
Newcastle Upon Tyne, NE1 8ST, UK
Thomas.woods@northumbria.ac.uk

Wai Ming Cheung

Northumbria University
School of Computing Engineering &
Information Sciences
Ellison Building
Newcastle Upon Tyne, NE1 8ST, UK
wai.m.cheung@northumbria.ac.uk

Kevin Hilton

Northumbria University
School, of Design
Argyle Street
City Campus East
Newcastle Upon Tyne, NE1 8ST, UK
k.hilton@northumbria.ac.uk

Roger Penlington

Northumbria University
School of Computing Engineering &
Information Sciences
Ellison Building
Newcastle Upon Tyne, NE1 8ST, UK
r.penlington@unn.ac.uk

ABSTRACT

This paper outlines the importance of sustainable product developments and their role in securing a sustainable future through current practices and procedures. It discusses the difficulties faced within organisations through the complexities and swamping of regulations when considering sustainability and the problems in policing such a system to ensure compliance. Focus is centred on the design stage, where large numbers of standards and interests must be factored in to create specifications that are highly compliant. Where there is a limited understanding of the complexities that are presented at this stage, less optimum specifications will be dispatched. This presents the need to think strategically with new systems and approaches which adapt to company behaviour, where decisions that are made at a design stage have impacts up and down the supply chain, changes that are made must be in line with company strategic objectives and provide influential returns on investment.

Keywords: Packaging, Sustainability, Supply Chain, Design, Specification, Best Practice, SME's.

1. INTRODUCTION:

Product development is a widely influential and complex activity, where the microcosms of decision making at the design and specification stage, are responsible for initiating 80% of environmental impacts during a products life-cycle. Decisions at the design stage have to encompass and reflect not only the company's strategic objectives and environmental concerns, but bear in mind the interests of company stakeholders, availability of resources, fit-for-purpose design, and technical feasibility of specifications within a complex supply chain that is regulated by Government standards and obligations for producer responsibility (Envirowise 2008). In the UK, businesses that are classed as 'Small & Medium Enterprises' (SME's), contribute to 99.7% of the total UK economy. Under the current regulatory system, due to infrequent and non-rigorous compliance inspections, overly complicated obligations and loopholes in fit-

for-purpose specifications, a significant proportion of these SME's go unregulated and undetected in terms of legal compliance for packaging obligations (Wilson 2010). Not only is the regulatory system backed up with few and far between prosecutions, but also a significant majority of SME companies are not obligated under any regulation procedure due to their smaller size and capacity, and therefore the level of environmental impact contributed due to non-compliance within this area, is unregulated and uncontrolled. For sustainable output, this presents a problematic scenario in that the largest contributing factors for the UK economy in packaging production, are ill advised of the correct procedures, unregulated nor inspected and contribute product packaging that is far from optimum and resource efficient due to lack of intrinsic knowledge, responsibility and awareness (Wilson 2010). Since the majority of impacts of product packaging life cycles derive at the stage of design and specification, such a grey area and lack of responsible practice could present significant and far reaching environmental consequences.

With such a complex area and such a range of possible scenarios, this research aims to refine the project focus looking to isolate best-practice and decision making at an organisational level, to enhance long term sustainable product development in a way that guides SME's in navigating best alternatives through the design stage and interconnected supply chains. If sustainability in this sector is to be improved, decision making at the design stage must be optimised, so that when potentially unregulated packaging enters the supply chain, it creates less impact during its life cycle.

2. LITERATURE REVIEW:

Where Environmental legislation plays an influential role, it is thought that procedures and practices need to be applied which give space to breath and think strategically, using systems that support current product development process and sit within organisational frameworks naturally, to complement decision making strategy (Ross 2010). With the complexity that is presented with taking on sustainability measures more structured communication of sustainability is needed, where a stronger connection between top-down decision making and bottom-up eco design practices are required as a combination, to integrate sustainability with a more informed pro-active approach (Manzini & Vezzoli 2009). Certain tools and frameworks exist to assist the functionality of sustainability within organisations, each playing a specific role when implemented in contributing to sustainable product developments, but too much emphasis apparently exists on the creation of such tools and little emphasis is sought on the actual implementation and improvement of these current tools, in practice (Manzini & Vezzoli 2009). For example, **Ems** (Environmental Management Systems) aim to provide an overall assessment of the organisations current capacities for making sustainable improvements within operations, and implementing changes within resource efficiencies. But, such systems require auditing procedures and investments of time and resources to highlight potential opportunities, requiring a behaviour shift at senior management level to request such an investment, which in turn then requires monitoring at various stages within the company. This kind of assessment would normally lead to the development of an environmental policy that will then outline the company's specific and most relevant strategic objectives. If such practices are coupled with cleaner production principles; Eco design and **LCA**, companies that adopt a more strategic approach in this manner can increase their chances of avoiding costs or fines implications, identify new market opportunities, improvements in productivity and enhance the company brand as a direct result of more responsible procedures (Hallstedt & Ny 2009).

The real challenge lies within the implementation (Mulvihill & Kramkowski 2010) of sustainability and dealing with entrenched habits and behaviours within company strategy (Singer 2010). Companies see little attraction with investing time and resources into making regulation changes if such changes generate additional costs or they believe that such changes are not important to their customers (Hallstedt & Ny 2009), (Martens & Moshin 2009) especially where the return on such investments is too long term and large infrastructure investments are required before a return on investment is realised (Martens & Moshin 2009). The growing number of sustainability tools that aim to assist implementation in parallel with increasing numbers of legislation, presents complications for industry, in how this growing number of tools

can be used in relation to each other planning for sustainability. For assistance a 'Framework for Sustainable Development' (FFSD) (Gasparatos 2009), can be implemented for building a principled definition of sustainability, that is applicable and specific to activities within the organisations sphere of influence (Hallstedt & Ny 2009) (Envirowise 2008). A principled definition specific organisational capacity, as opposed to a scenario, allows open-ended non-prescriptive co-creation towards sustainability, assessing how respective methods tools and concepts relate to each other and relate to sustainability within the organisation.

In spite of the increasing awareness of assistance and the importance of sustainability, the majority of companies have still not moved into the area of implementation. Decisions regarding sustainability are normally taken at the senior management level, whereas other organisational levels such as product development are hopefully aligning their work within the strategic directions of the company. Several case studies (Hallstedt & Ny 2009) in pioneering companies have helped to create the 5 stages of sustainability integration:

- Pre-Compliance: Ignoring sustainability and opposing related regulations.
- Compliance: Obeying laws and regulations on labour, environment, health and safety.
- Beyond Compliance: Recognizing the opportunity to cut costs mainly through higher resource efficiencies and reduction of waste, leading to both financial and ecological gains. Sustainability is still separated from core business development.
- Integrated Strategy: Sustainability is integrated in the company's vision and informs key business strategies to be more successful than competitors through innovation, design and improved financial risk assessments.
- Purpose and Passion: This is actually not a next stage of development for most companies but rather a special type of companies, being originally designed to 'help saving the world'.

It has been noted that it is less common for SMEs to work actively with environmental issues as oppose to Large or medium sized companies, where SMEs tend to be found situated around the area of compliance (or below) rather than moving beyond, even though there are apparent benefits for doing so. Still, even though larger companies are more adept at implementing strategic decision making throughout the organisation, decision support systems such as; business plans, budget and review tools for competitor strengths and customer requirements, there still lacks formalised procedure to find and identify the companies sustainability challenges, and inform those at a senior level (Hallstedt & Ny 2009). Product and environmental departments in general seem to have difficulty communicating sustainability issues in a way that fits the quantitative econometric support tools that senior management often use. This means that environment and sustainability measurements must be broken down into concrete categories or attributes that can be understood quantified and addressed to become part of company strategy. Where larger companies follow up and justify decisions and activities with sustainability, in particular for SMEs, actions are not covered by such systematic support, resulting in operations sitting mostly at, or below levels of compliance. Lack of senior management support can be a major barrier to implementing sustainability efforts, especially SME's. This indicates deficiencies in regarding the ability to understand, interpret and define sustainability, its business case, and to communicate it between organisational levels where standardised support tools to assist here, especially for SMEs would be a benefit. Research is needed, to guide the development of strategies and policies (Singer 2010) which influence and encourage engagement with sustainability through new paradigms of innovation (Martens & Moshin 2009). Iterative flexible decision making is needed at an operational level, which integrates conflicting priorities with an armoury of mechanisms, working as an initial procedural method for sustainable implementation, but becomes a central reference point for decision making once accepted.

3. PROPOSED APPROACH / METHOD

3.1 Approach and Method for industry issues.

It is intended to investigate an advanced framework for helping implement decisions at the design stage of product development. As 80% of the environmental impact is incurred at design stages, it is important that decisions made are both in line with strategic company goals, but also offer as much opportunity for reductions in environmental impacts as possible when developing new products. Due to the numbers of tool kits available, a guiding framework will be proposed that assists in communicating best-case practice available for sustainable product developments, suitable for the recipient organisation. Functionality may range from choosing the right tool-kit for sustainability processes, improving the communication and awareness within supply chain procurements and specification procedures, open up in house resource efficiencies or information regarding new sustainable materials. New research will aim to assist in bringing together information relevant for decision making at both a product development and strategic management level whether it be internally or across contracted distances, as shown in Fig. 1, A & B. This may extend itself to the adjoining supply chain with suppliers and clients, to ensure that the optimum level of sustainable capacity can be achieved in relation to all involved, aiding communication between all parties during specifications. Such a system will need to carry the ethos that best practice denotes from the current Regulations and Obligations (Fig. 1, C & D). As the complexity of such regulations and the incentivisation of best practices can be elusive to those obligated, and also evade those who are not, a framework that can incorporate the essence of good practice that works on a ground level for SME's, may begin to push outputs in a more sustainable direction.

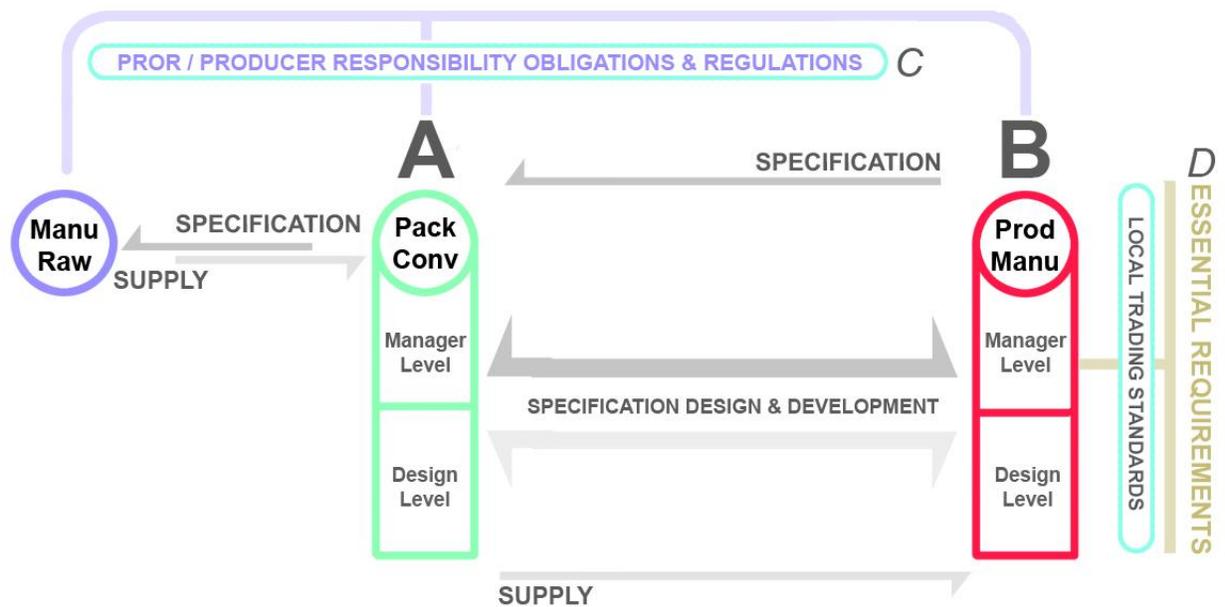


Fig 1: Shows the focus of the research mapping packaging design process and decision making procedure.

If the control of ensuring compliance is difficult once a product has entered the supply chain due to varying responsibility and get-out clauses, any maximisation of sustainable advancements need to happen at a decision making level, so that their individual impacts become less, where regulation and obligation further on may fail. This type of approach will aim to fill the gap at SME level, where companies are neither obligated by responsibility, nor akin to the 'spirit' of the law, rather than enforcing change from an outside perspective, this method would work from the inside-out, instead.

3.2 Approach to the research activity:

Narrowing the research to the packaging sector should provide quicker turnaround to output of new product packaging to the marketplace. Having a larger number of product turnovers should allow the research to map out company procedures through case-studies. Understanding company operations will be essential for refining eventual framework improvements. To find the niche area within the packaging sector, it is first important to identify the crucial areas of issue within the supply chain and their relationship with each other to tailor any improvements to naturally sit within current practices. Observing the interplay between specification, as shown in Fig. 2, A and production Fig. 2, B, within the supply chain, will help to clarify and highlight where improvements may be implemented within deeper research. This has begun by mapping out the packaging supply chain relationships of the stakeholders within it by way of trial and error, through literature and correspondence with packaging consultants to verify the overall system. Once the overall supply chain has been defined (Fig. 2), a simple questionnaire will be sent out to the supply chain sectors, to begin gauging the level of sustainability compliance, procedure within design specification, level of awareness, responsibility and capacity for compliance and change. This generic survey will help to assist in justifying where more focused investigation is needed for implementing improvements within the packaging sector, and also help find candidates for case-study. Once target sectors within the supply chain are chosen, a more in depth questionnaire can be directed in regard to procedural operations that inform design decision making, within our targeted industry sectors. The aim of this will be to understand in detail, how chosen organisations are informing specifications, using sustainable materials, handling resources and working with others in the supply chains, to identify opportunity for improvements that reflect good sustainable practice.

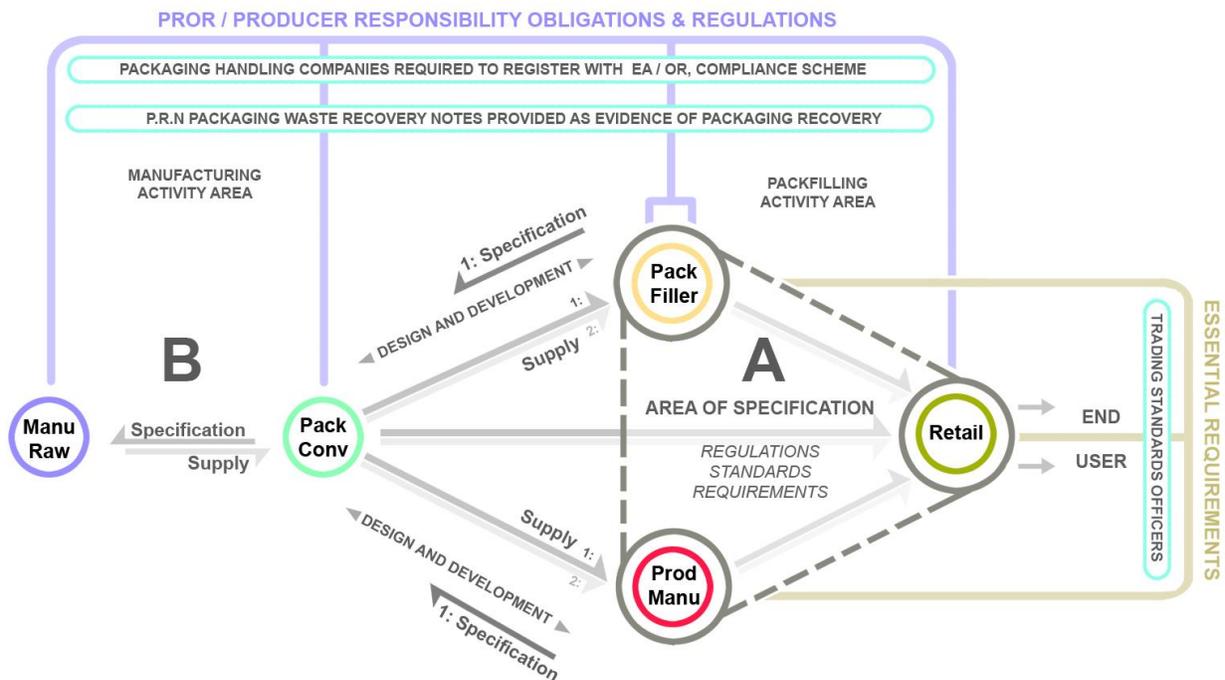


Fig 2: Shows the eC complexity of the packaging supply chain and the process of Specification in fruition.

In the case that SME's show the most difficulty in adopting good practice in sustainable developments due to a lack of knowledge, over complexity of regulations, and that an overwhelming proportion of these businesses are not obligated, there lays good opportunity for improvement where regulation cannot reach. Understanding the fruition process between the packaging producer and retailer (Fig. 1 A & B) will be necessary to pinpoint where better communication, understanding, choice and awareness may be imple-

mented. Case study approach here will be most useful. Case studies here will serve to map out company process on a number of levels. Firstly the process of engagement at a design level, when taking a new project from initiation through to fruition. This study will aim to enquire what types of tools and methods are being implemented to assist the decision making process at the design stage, and how these decisions are matched against the company strategic objectives at a management level (Fig. 1, B). This part of the study will aim to highlight best practice, or improvements for best practice within the flow of information informing decision making process, aligning to the spirit of regulation and obligation. The second part will map out the interactions between the product manufacturer / retailer (Fig. 1 A & B), and the packaging manufacturer with the interrelations at play of information and responsibility that is passed between both parties. Understanding the networks of information between adjoining parties will enable the research to highlight best practice in communication over distance, and suggest where issues arise, methodology for improved decision making which, involves not only the design stage, but the effected and inter-linked supply chain in parallel, which is crucial for product development success.

4. CONCLUSION

Improving the visibility of actions and highlighting opportunities through advanced frameworks, could allow a change in behaviour which can be transferred between differing SME process. From this broad set of data, the aim will be to innovate new approaches, which tackle this complexity and contribute new knowledge through the implementation and iterative development of new procedural frameworks, for future sustainable product development, in the SME packaging sector.

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REFERENCES

- Envirowise Guide., 2008. Packaging design for the Environment.
- Gasparatos, A., 2009. Embedded Value Systems in Sustainability Assessment Tools and their Implications. *Journal of Environmental Management* 91 (2010) 1613 – 1622. (Gasparatos 2009)
- Hallstedt, S, Ny, Henrik., 2009. An approach to assessing sustainability intergration in strategic decision systems for product development. *Journal of Cleaner Production* 18 (2010), 703 – 712.
- Manzini, E, Vezzoli, C., 2009. A strategic design approach to sustainable product service systems: Examples from ‘environmentally friendly innovation’. *Journal of Cleaner Production* 11 (2003), 851 – 857.
- Martens, P, Moshin R., 2009. Is globalisation sustainable? *Sustainability* (2010), 2, 280 – 293.
- Mulvihill, P, Kramkowski, V., 2010. Extending the influence of scenario development in sustainability planning and strategy. *Sustainability* (2010), 2, 2429 – 2466.
- Ross, A., 2010. Its time to get serious – Why legislation is needed to make sustainable development a reality in the UK. *Sustainability* (2010), 2, 1101 – 1127.
- Singer, M.; Eco-nomics: Are the planet-unfriendly features of capitalism barriers to sustainability. *Sustainability* (2010), 2, 127 – 144.
- Tovey, H., 2010. Sustainability: A platform for debate. *Sustainability* (2009), 1, 14 – 18.
- Wilson, C., 2010. Compliance With Producer Responsibility Legislation: Experiences From UK Small and Medium-Sized Enterprises. *Business Strategy and the Environment*.