Abstract

Sustainability encompasses three elements; economic, social and environmental. Sustainable development aims to reduce impacts of all three elements. Currently, there are a number of tools for assessing products' sustainable impact and improving their performances. Life cycle assessment (LCA) is one of the more commonly used tools for such purpose. LCA is used for assessing environmental impacts associated with all the phases of a product's life from cradle-to-grave (raw material extraction, manufacturing, distribution, use, and end-of-life). Similar tools were developed to assess economic and social impacts, such as life cycle costing (LCC) and Social-LCA (S-LCA).

However, these tools compare products on the basis of shared functionality (A functional Unit), for example when comparing a pen and a pencil a functional unit that prescribes 'the drawing of a line 20km in length', will have to ignore other non-shared functions such as permanence, fragility, etc. As the corresponding shared functionality decreases, so the validity of any comparison becomes weaker, such as the comparison between a horse and a car as a mode of transport. Furthermore, while sustainability improvements can be achieved using these tools; they are generally limited to reducing the negative impacts and optimising efficiencies at each stage of the life cycle and ignore the potential benefits of increased functionality and positive benefits.

This paper proposes that a fairer and more accurate assessment of a product would include its positive impacts 'value' at an individual and societal level. Furthermore, consider the 'value' of a product as well as its environmental, social and economic impacts would provide a much fairer basis on which to allocate resources in a resource constrained future where difficult decisions will inevitably have to be made.

This research has particular relevance in supporting strategic planning decisions aimed at increasing future resilience in manufacturing companies. At present, sustainable assessing tools offer little or none in value assessment, particularly during the use phase of products. The research presented in this paper indicates that the measurement and assessment of these positive benefits will be a key decision factor in a resource critical future, where decisions will be made based on the inherent value of products, providing a more socially equitable and responsible way of distributing resources. This paper reports specifically on the addition of this value consideration in product assessment within the UK toy industry, however it is clear

that these findings have a broader significance across all manufacturing industries and geographic regions.

1.0 Introduction

Global governments and population have shifted their focus to sustainable development as the economic effects of impacts on environment have drawn attention to sustainable challenges. Sustainable development is defined as development that meets the needs of the present without compromising the ability of future generations to meet their own needs" in the UN Environment Commission Report in 1987, more commonly known as the Bruntland Report. A more recent and less ambiguous definition is provided by Rahimifard (2007) as development that breaks “the link between economic growth and environmental degradation whilst safeguarding social/ethical standards”. This new definition encompasses the three dimensions (pillars) of sustainability as shown in figure 1.

At present, the impacts on the environment from human activities are becoming more apparent. Regular media coverage on issues such as climate change, loss in biodiversity and pollution is being increasingly reported (BBC News 2014). However, the economic impacts of these environmental issues are not always as obvious and well covered, although it has driven changes in manufacturing, which in turn affect society. For example, the slow recovery in the US and Europe from the recent financial crisis can be attributed in part to the restriction in global supply and increasing prices of key raw materials, food and energy costs (Global Footprint Network & Mediterranean Ecological Footprint Initiative 2012).

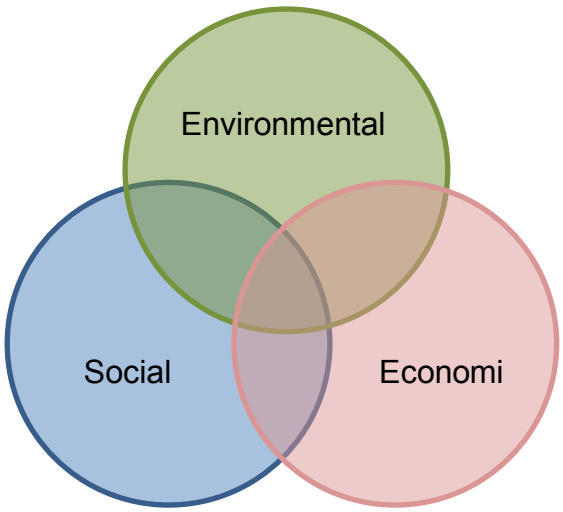

Figure 1 Venn diagram showing the three dimensions of sustainability and their interconnectedness

It is predicted that these trends will continue, increasing pressure both economically and socially. Many governmental and corporate organisations have carried out forecasts and assessments to comprehend world changes in the near future (European Commission 2012; DTI 2002; WBCSD 2010; UNEP 2012; OECD 2012). A number of key trends regarding the resource distributions are identified and summarised from a series of studies and reports:

- Global resource consumption will continue to rise, driven by a growth in global population coupled with emerging markets and improving living standards in developing countries, and an ageing population in developed countries.
- Resource depletion, energy security and water scarcity will continue to cause supply and cost problems.

1.1 Materials consumption and resource depletion

It is estimated that 1.5 planets worth of resources are required, just to support the world's current consumption (Global Footprint Network & WWF-Hong Kong 2013). Due to huge growth in global population, the reliance on finite resources to meet its needs and wants may eventually consume all accessible resources (Rahimifard et al. 2013). Consumption of finite resources is one of the critical dilemmas that need to be addressed in achieving sustainable societies; with efficient manufacturing, distribution, consumption and disposal of goods being a key component of this. Although resource efficiency has been traditionally driven by economic objectives (Dahmus & Gutowski 2005); maximising financial profits through efficiency in labour, materials and energy consumption (Womack et al. 2007). The same approaches have been transferred to embrace sustainable strategies where greater emphasis have been placed on not just the profit and loss account but conservation of resources and efficient consumption of materials, water and energy.

This current trajectory of increasing consumption and diminishing resources, and the noticeable effects of human activity on the environment make it inevitable that substantial environmental, social and economic changes will be required. Although, significant improvement measures were introduced due to increasing awareness of our sustainable impacts (UNEP 2012; DECC 2012), it has become increasingly evident that these efforts are not enough (UNEP 2011); radical changes are required in order to meet the targets as illustrated in figure 9. Furthermore, Stern (2007) asserted that in order to mitigate the effects of our current impacts, 80% reduction of present damages is required as shown in figure 2.

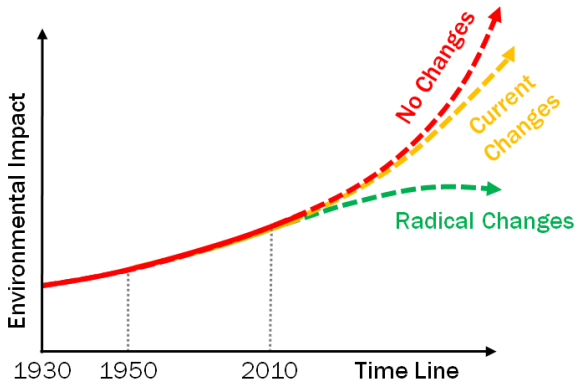

Figure 2 The environmental impacts gap

Therefore, it is widely accepted that meeting such difficult targets in the near future will require a strategic, integrated, and radical approach, and a momentous change to current production and consumption system (Global Footprint Network 2011).

2.0 Overview of tools for sustainable assessment

The three dimensions of sustainability have received differing degrees of attention from research communities over the years (Colantonio & Potter 2006). Sustainable development debate was dominated by environmental issues in the 1980s to mid-90s. Subsequently, economic concerns were connected and included into the debate in the mid-90s to late 90s and social issues only took up more focus by the late 90s (Marghescu 2005) as demonstrated in figure 3. This is due to a shift of stakeholders concern (Brent & Labuschagne 2006).

It is widely agreed that the three dimensions have been prioritised unevenly (Drakakis-Smith 1995). This was mainly because sustainable development was generated from a combination of the green movement of the 1960s and the "basic need" advocates of the 1970s, but also assessing social elements presents difficult measuring challenges (Colantonio 2007). Indeed, social considerations have almost been treated as some kind of afterthoughts in sustainable. OECD (2012) points out that social sustainability is considered in terms of the social implication of environmental politics instead of an equally integral component of sustainability.

Currently, there is an extensive range of specific, independent sustainable tools available. These tools can be employed to measure the environmental and social sustainability of product and/or services. They enable sustainability to be properly considered in all activities and can be used to provide recommendations for more environmentally and socially conscience decisions. Existing tools can be grouped into six main categories depending on

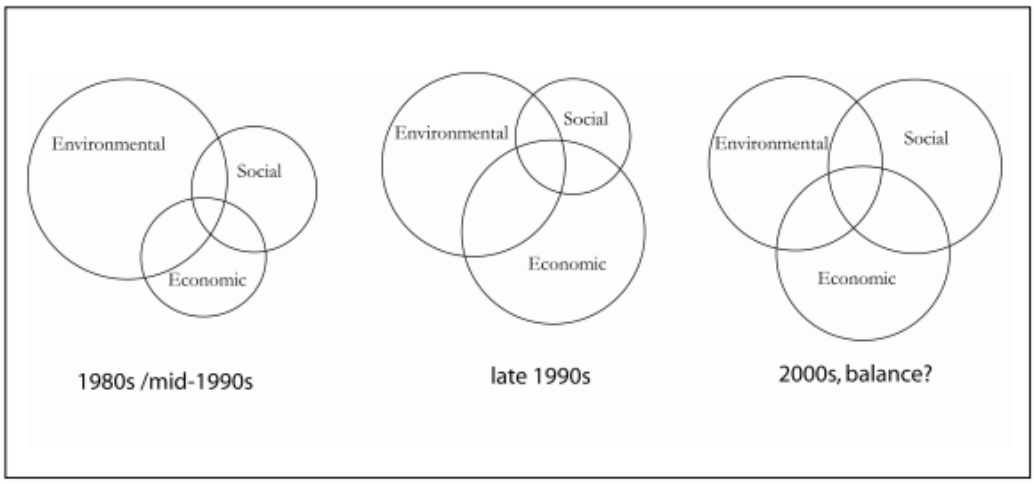

Figure 3 The different dimensions of sustainable development and their relative importance (adapted from Marghescu 2005)

their approaches (Baumann et al. 2002); Frameworks, checklists and guidelines, ratings and ranking, analytical, software and expert systems and, organising.

These tools normally focus on different aspects of various sustainable priorities (Ehrenfeld & Lenox 1997). For instance, the MET matrix (Material Energy and Toxicity) specifies a checklists for structured analysis against guiding principles (Brezet & van Hemel 1997). MET matrix is often applied alongside the product design process. Its analysis also encompasses the product's entire life cycle. Whereas, Design for Recycling (DfR) provides conceptual guidelines for best practices, it is typically applied to more developed concepts and only concentrates on the end of life of a product (Henstock 1988).

These tools can be used as stand-alone tools as well as a compilation of tools be applied concurrently. However, only a handful of these tools actually consider the social factors, thus many existing tools should really be labelled as eco-tools rather than an all-encompassing sustainable assessment tools. There has been a vast amount of social research studies and policy documents that propose many objectives and measuring instruments, and yet they are rarely integrated in the sustainability framework completely. A number of tools have been developed, either from scratch or adapted from existing tools. However, they are underdeveloped and do not provide a fully comprehensive assessment (Brent & Labuschagne 2006; Macombe et al. 2013).

In general, there are a huge number of tools and methodologies for sustainable development. The basis for economic assessment from an enterprise level to a product level is to optimise financial income and minimising expenditure. Tools such a life cycle costing (LCC) (Rebitzer

2005); and the Lean practices have enabled the economic assessment from an enterprise level to a product level (Womack et al. 2007). Conversely, sustainability assessments that evaluate the other two dimensions (social and environmental) offer little considerations on the positive impacts (sustainable gain) and recommendation for improvement tend to focus on reducing the negative impacts (sustainable loss) as illustrated in figure 4. This may drive towards a net improvement, however enhancing the social and environmental gain will be more effective. Assessment for the inherent social value or gain will have increasing importance as financial capability will not be the only deciding factor for fair resource distribution in a material scarce world.

2.1 Tools for social assessment

There are a number of tools that measure the social dimension of sustainability. They are developed to be applied at different level of control (strategic, tactical, and operational) and either focus specifically in social sustainability or integrated into a bigger sustainable framework that encompasses all three dimensions. SLCA or Social-LCA (Social Life Cycle Assessment) is a more common tool that focuses specifically in social factors. Ecological Footprint and CSR (Corporate Social Responsibility) are tools that have a wider scope that consider all dimensions (Rees & Wackernagel 1996). CSR and SLCA are two of the more established and used methodologies, the structure and processes are reviewed.

SLCA follows the same methodology and framework of LCA (life cycle assessment). LCA is widely accepted to be a well-developed methodology for assessing environmental sustainability. It quantitatively evaluates the environmental impacts of a product and/or a service. The International Standards Office has constructed a standard methodology in the form of ISO: 14040 (ISO 2006a) and ISO: 14044 (ISO 2006b). As its name suggests, LCA apply a holistic, all-encompassing approach to assess a product and/or a service throughout its entire life cycle: from raw material extraction through to product disposal. LCA has four distinct phases; Goal and Scope Definition, Inventory Analysis, Impact Assessment, and Interpretation.

The purpose of study is defined in the goal and scope definition phase, along with system boundary and any assumption stated. It is also the phase where a functional unit is set. A functional unit is used as a reference to analyse and compare different products. It is a clear precise statement that describes the service of a product where inputs and outputs can be related (Rebitzer 2002), i.e. A device to boil 1 litre of water twice a day for three years.

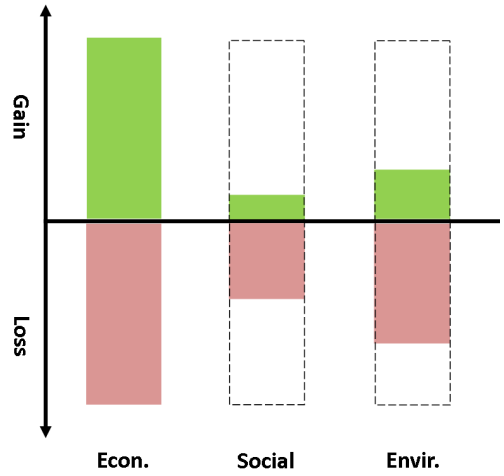

Figure 4 Diagram highlighting the current status of positive (gain) and negative (loss) evaluation of each of the three dimensions of sustainability.

The second phase is inventory analysis, where all environmental flows in and out of the product system are collated. This is typically the most time consuming phase. The third phase is the impact assessment where impact categories and characterisation are identified and applied to the data from the second phase. Interpretation is the final and fourth phase, where opinions and conclusions are drawn from the study. However, LCA is by no means the most holistic assessment tool. There are still a lot of unresolved limitations to all 4 phases of LCA as Shown in Table 1:

Phase	Limitation/ Problem
Goal and Scope definition	▪ Functional unit definition ▪ Boundary selection ▪ No social and economic decision ▪ Alternative scenario considerations
Life cycle inventory analysis	▪ Allocation ▪ Negligible contribution criteria ▪ Local technical uniqueness
Life cycle impact assessment	▪ Impact category and methodology selection ▪ Local environmental uniqueness
Life cycle interpretation	▪ Weighting and valuation ▪ Uncertainty in decision process
All	▪ Data availability and quality

Table 1 LCA phases and limitations (adapted from Reap et al. 2008)

It is apparent that current LCA only consider environmental issues, and SLCA is one of many developments that use LCA methodology and approaches as backbone (Finnveden et al. 2009). The same limitations are also transferred to these new methodologies and a number of these limitations actually have a profound influence on SLCA. Functional unit causes much debate from researches. The functional unit definition has three major limitations. Firstly, it is difficult to quantify "soft" and ambiguous functions. Functional unit is rather limited to handle more ambiguous functions, which makes it hard to define and compare (Cooper 2003) (Reap et al. 2008). Examples of this limitation are functions such as the aesthetics properties and sentimental value provided by a product. This issue has a greater influence on the effectiveness of a social assessment as compared with an environmental assessment. Secondly, it is difficult to define a comprehensive functional unit that includes multiple functions while function unit is supposed to fully describe the product's functions (Finkbeiner et al. 1997; Ruhland et al. 2000). Lastly, functional unit can act as a common denominator for products comparison, however two products that have different functions may not be comprehensively reflected as the a vague common function was forced to be used for the assessment (Hischier & Reichart 2003). This limitation deems LCA to be ineffective while resources distribution decisions are to be made, either at a corporate level where executives have to decide on different product ranges or at a legislative level where governments have to decide on what companies get the competing resources.

Another process of LCA that makes it difficult to compare products with or without a common function is the definition of assessment boundaries. It will be an unfair comparison when two products are compared with different boundaries. And only experienced practitioners will be able to identify over "cut-off" which affect the results of assessment greatly (Reap et al. 2008). An example of this may be the presence of batteries in assessments for electronic toys, where the batteries heavily influence the recommendation for redesign activities while there are other issues to be addressed as well (Catalan Waste Agency 2008; Muñoz et al. 2008).

The geographic uniqueness also makes inventory and impact data less relevant while site specific data are hard to be obtained. The existing data are used for all general purposes, which raises the issue with geographical fit of the assessment. A lot of the impacts are actually closely related to regional influence which LCAs fail to address the uniqueness (Kerwitt et al. 2001). The geographical uniqueness will affect the social assessment even greater, as specific ethical and cultural differences are less well-known.

Social Life cycle assessment follows the exact four-phase mythology of LCA with functional unit and boundary and scope definition. The UNEP/ SETAC SLCA methodology has been developed with the framework highlighted by (Dreyer et al. 2006). Dreyer et al (2006) set up the framework for social product assessment, and laid down the foundation for definitions of stakeholder groups, sub-categories of stakeholders and impact categories.

A product life cycle flow chart is normally plotted and inventory and impact assessment are carried out in every single process relating to their geographical locations (Franze & Ciroth 2009; Franze et al. 2010; UNEP 2009). The typical stakeholders are identified in figure 5. In each of the stakeholder categories, lists of subcategories are also defined (Table 2). Further specific stakeholder categories and subcategories can be defined and used (Benoît et al. 2010).

Different impact categories are allocated to subcategories in order to access the associated inventory indicators. Typical impact categories are; Human rights, Working conditions, Health and safety, Indigenous rights including cultural heritage, Governance, Socio-economic repercussions. These impact categories are measured and assigned to each stakeholder subcategories following the framework constructed by Benoît et al. (2010) as shown in figure 6.

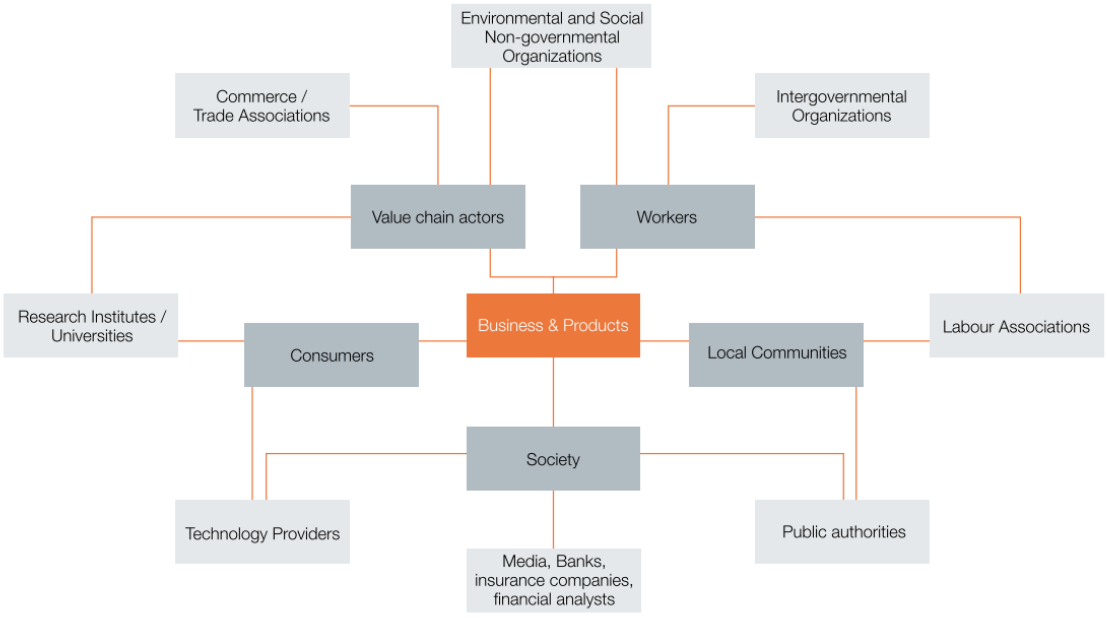

Figure 5 Hub and spoke stakeholder diagram (adapted from UNEP 2009)

Stakeholder categories	Subcategories
Stakeholder "worker"	Freedom of Association and Collective Bargaining Child Labour Fair Salary Working Hours Forced Labour Equal opportunities/Discrimination Health and Safety Social Benefits/Social Security
Stakeholder "consumer"	Health & Safety Feedback Mechanism Consumer Privacy Transparency End of life responsibility
Stakeholder "local community"	Access to material resources Access to immaterial resources Delocalization and Migration Cultural Heritage Safe & healthy living conditions Respect of indigenous rights Community engagement Local employment Secure living conditions
Stakeholder "society"	Public commitments to sustainability issues Contribution to economic development Prevention & mitigation of armed conflicts Technology development Corruption
Value chain actors* not including consumers	Fair competition Promoting social responsibility Supplier relationships Respect of intellectual property rights

Table 2 Stakeholder categories and subcategories (adapted from UNEP 2009)

The essence of SLCA lies within the inventory data and the allocation of data to the stakeholder categories and impact categories. However SLCA itself is still under developed and cannot provide a comprehensive assessment for decision support (Macombe et al. 2013). Impacts assessment requires further research. There is a need to widen the scope of stakeholder categories and subcategories. Impact categories also need (Lehmann et al. 2011). SLCA also struggles to assess the use phase of the product life cycle (UNEP 2009), also a generic LCA should consider all phases of the life cycle, impact categories are particularly difficult to define as specific beneficial values are hard to quantify.

Conversely, CSR is developed as a paradigm switch from governmental governance to voluntary initiatives and corporate self-regulation to achieve sustainability over the last two

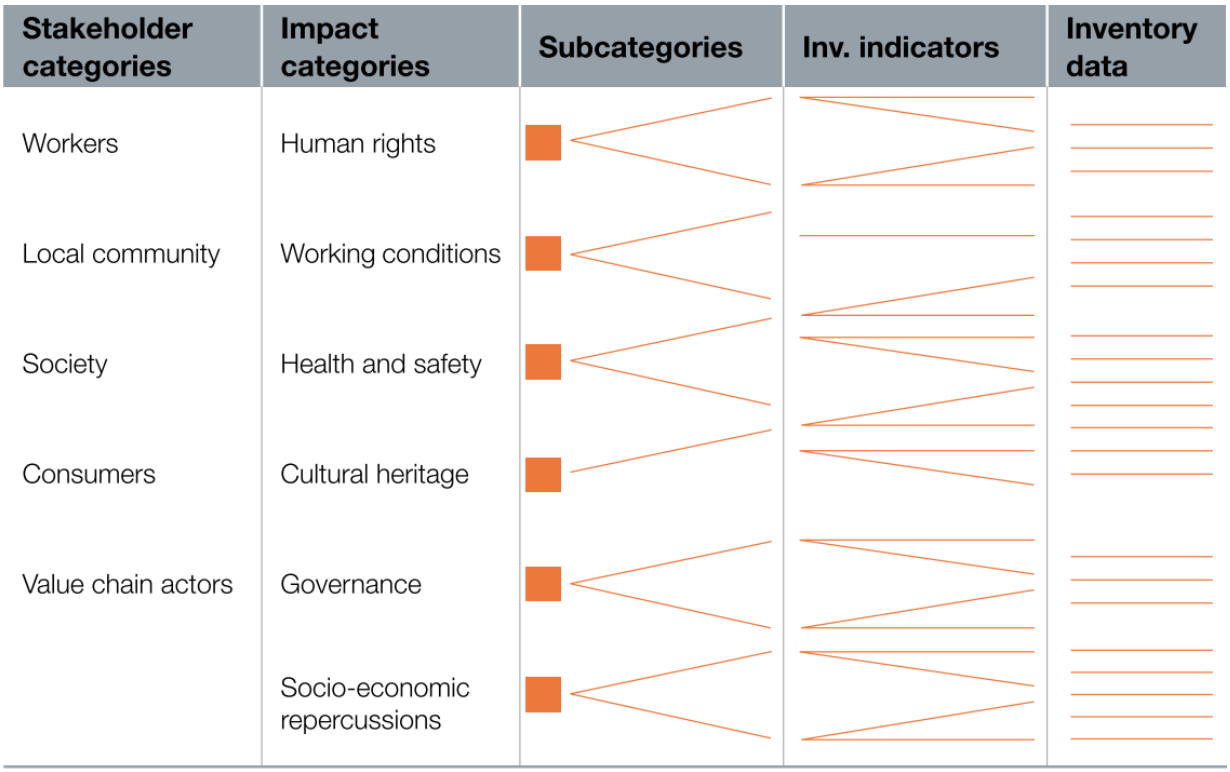

Figure 6 Assessment system from categories to unit of measurement (adapted from UNEP 2009)

decades. Many corporations and businesses welcome these ideas of partnership and co-regulation instead of a traditional 'command and control' approaches.

As pointed out in previous paragraphs, researches carried out in the 90s have broadened the scope of investigation to include social and cultural concerns as well as environmental issues. They are normally depicted by the terms "socially" or "ethically" responsible. Vogel (2005) highlighted the need to include social factors, such as poverty, health and child welfare, into sustainable considerations with the use the two cases. They pointed out the cases of the dispute between the Ogoni population and Shell in the early 90s and the well documented case of NIKE's employment of child labour in Pakistan in the mid-90s.

CSR is a framework that allows companies to demonstrate their commitment to identify and minimise their negative impacts associated with their operations, which affect society and environment. The framework, in theory, should encompass all three dimensions of sustainability. Upon reviewing literatures of CSR, 5 common features have been identified:

- going beyond legal requirements and duty to shareholders (Bloom & G.T 2001) being voluntary in nature (European Union 2001)

- meeting responsibilities to internal and external stakeholders (Maignan & Ferrell 2000)
- integration of social and environmental concerns into business operations (Van Marrewijk 2003)
- optimising positive effects and minimising negative effects of the company's actions (Lantos 2001)
- objective concern for the welfare of society (Hartman 1998)

These features are well accepted, and nowadays it will be hard to find a major corporation reports without some form a CSR reporting. This also highlighted the important business case for CSR (Carroll & Shabana 2010; Vogel 2005)

Despite this increase, it is worth pointing out that some standards are mere expressions of principles without mechanism for implementation, monitoring or verification of compliance. By contrast, some others entail a more rigorous process of examining, measuring, testing or otherwise determining the conformance with the requirements specified in an applicable standard. In addition, companies have often chosen what to report on (Vogel, 2005).

The typical activities applied by companies are summed up in 6 areas:

- Statement containing explanation of SRI (socially responsible investment) in relation to investment activities, outline of actions and objectives
- Identifiable staff responsible for CSR products and services
- Publish regular reports of CSR activities/performance
- Inform CSR criteria and product development through regular committee meetings (external and internal staff)
- Offer service to institutional investors which targets engagement activities in accordance with individual organisations' preferences
- Certification programmes and voluntary standards

(Rapson et al. 2007)

These activities typically involve setting policy statements, advisory committees, reporting and certification schemes. Reporting and certification are normally endorsed by external third party while the other activities are carried out internally. There has been a steady rise in corporate social reporting since 1990s, growing from less than 100 companies to more than 500 in 1999 (Vogel 2005). However, existing standards on reporting can be easily

manipulated, companies often chose what to report on. This is because some standards are merely expressions of principles without any form of procedures for implementing, monitoring and verification of compliance. Whereas, some detailed a more thorough process of examining, measuring and testing for compliance to a specified requirement (Font & Bendell 2002).

Many researches point to the voluntary nature of CSR as the driver for integrating social and environmental considerations into core corporate activities. However, other have differing views, pointing out that the criteria set in CSR reporting and certifications are often set beyond financial and technical capability of many SMEs. As a result, CSR are often limited to bigger organisations (Kinderyte 2008). Furthermore, many standards for corporate human rights are ill-defined, while investments in monitoring these issues tends to be media, public relation driver (Vogel 2005).

Fundamentally, CSR is more than often used as a smoke screen to demonstrate all the "positive" activities while masking all the other impactful activities. Perhaps Porritt (2005) give the most perfect summary in this fundamental limit of CSR practice:

The very fact that the majority of companies still opt for CSR as the self-contained box into which to pack all their 'good stuff', while they continue to pursue their core business (quite legally and, indeed, quite logically, given the failure of politicians to change the rule) without the remotest likelihood that they or their products/services will ever become genuinely sustainable, reveals all one really needs to know about the empty, seductive illusion that is CSR (Porritt 2005)

Comparison of LCA, SLCA and CSR

In terms of the scope of investigation, CSR covers all three dimensions of sustainability while LCA and SLCA only address environmental and social aspects respectively. Figure 7 below demonstrated the different levels of corporation that each of these tools reach. CSR type 1 is where data collection is conducted at a top enterprise level, type 2 is where the data collection is carried out at enterprise and facility level and type 3 is where data collection expanded to external supply chain (normally limited to first tier network). Whereas SLCA and LCA approaches allow the assessment reach a detailed level of processes in production. Social impact assessment and Environmental impact assessment are simply one phase of LCAs, however, they are sometimes utilised on individually for a quicker assessment.

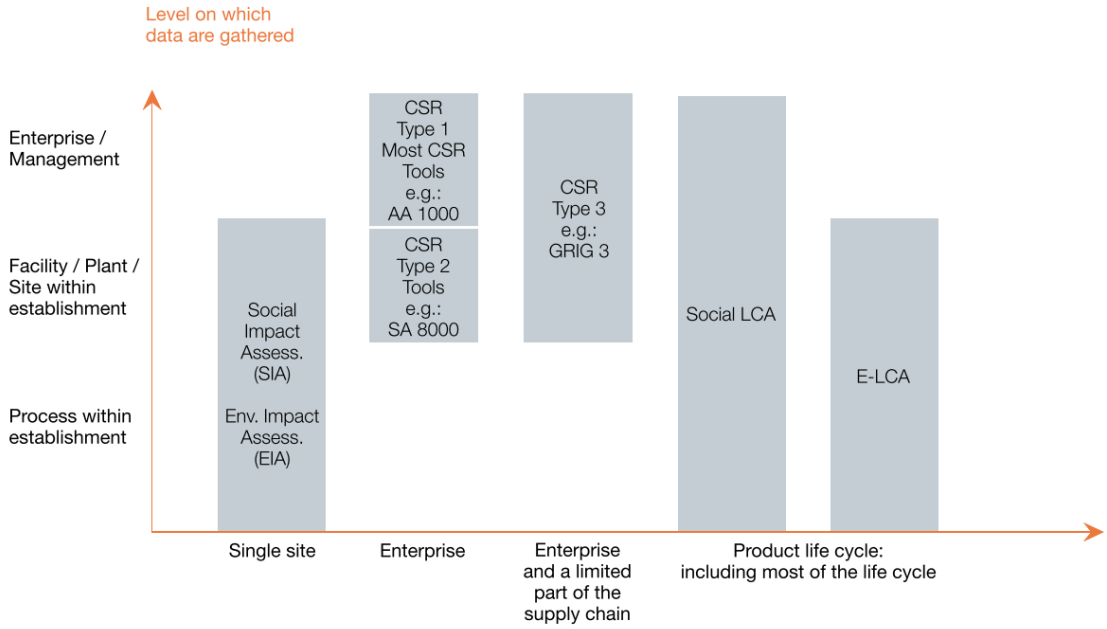

Figure 7 Scope of system over which results are gathered and reported in as assessment (adapted from UNEP 2009)

In practise, CSR is more effective as a tool to set strategic goals for an organisation and it will be difficult to have the strategy translated into specific targets. SLCA is a product specific assessment that evaluates the entire life cycle, however most of the social impacts measured are within the production and distribution supply chain, and the consumer subcategories are enterprise system related, such as health and safety, consumer privacy and feedback mechanism. Both CSR and SLCA offer little or no assessment of the products' inherent impacts, both positive and negative. Furthermore, current sustainable product assessment tend to offer improvements in the form of negative impact reduction (reducing loss) rather than actually creating, cultivating and enhancing positive product impacts (increasing gain). Lastly, without the assessment of positive societal impact, it is difficult to assess and compare products with different functions; therefore it will be difficult to distribute resources fairly.

In summary, there are a big number of existing sustainable tools that offer various assessment and support for businesses. Whilst economic decisions are well supported by a plethora of commercially available tools and techniques, and environmental decisions are, to a lesser extent, also supported but primarily around negative impacts (environmental cost), social decisions are limited to very specific issues (child labour, customers' privacy), primarily negative impacts. Furthermore, the existing tools that consider the social aspects of sustainability offers little or no assessment of a product's social value. This makes it difficult to compare products.

3.0 Framework

The assertion based on the findings of the previous sections is that in order for companies to improve their resilience, in a resource constraint future, new tools, methods and techniques are required that enable the evaluation of the company and its products and services, in terms of their societal benefits against their environmental costs. The following section proposes the foundations of a framework for supporting companies in achieving these aims at strategic, tactical and operational levels within the organisation.

A good business strategy provides a vision for a company which can be used to unite the business through a shared purpose and goal. This framework supports the implementation of a strategy which is intended to strengthen the company access to limited resources through maximising the positive societal benefits of its products and services whilst minimising there negative environmental and social impacts. The structure and mechanism of the framework is illustrated in figure 8. However, in order for a company to develop the objectives and actions required to implement this strategy, their current position, trajectory and velocity, in relation to this strategic goals, must first be established. In smaller companies it may be possible to achieve this by simply focusing on the individual products and/or services, however in larger organisations, the sheer scale, range and complexity often requires a degree of 'business segmentation' by grouping product, services or functions into common categories (e.g. divisions, departments, categories, markets, brands). This first stage of the framework will support the assessment of the business at each level, from division to product, sector to service and translate this understanding into a series of actions and objectives can be defined.

Step One: The Cost Benefit Matrix (CBM)

The first step in this initial stage of the framework is to determine the current position of the company in relation to its strategic aim. What is the 'cost' of the operation, service or product (environmental, social and economic) versus its benefit (environmental, social and economic). However some of this information should already be known and sufficient methods and tools exist within most organisations to achieve it. For example economic cost/benefit or profit and loss, is an integral part of business management and therefore should already be understood. Other factors, such as social, should not have significant 'social' costs associated with them. Most negative social impacts are associated with the misuse of a product not its intended use. Environmental impacts tend to be negative not positive, particularly in its production and end of life stages, whilst positive impacts in the use phase tend to be limited to a very small

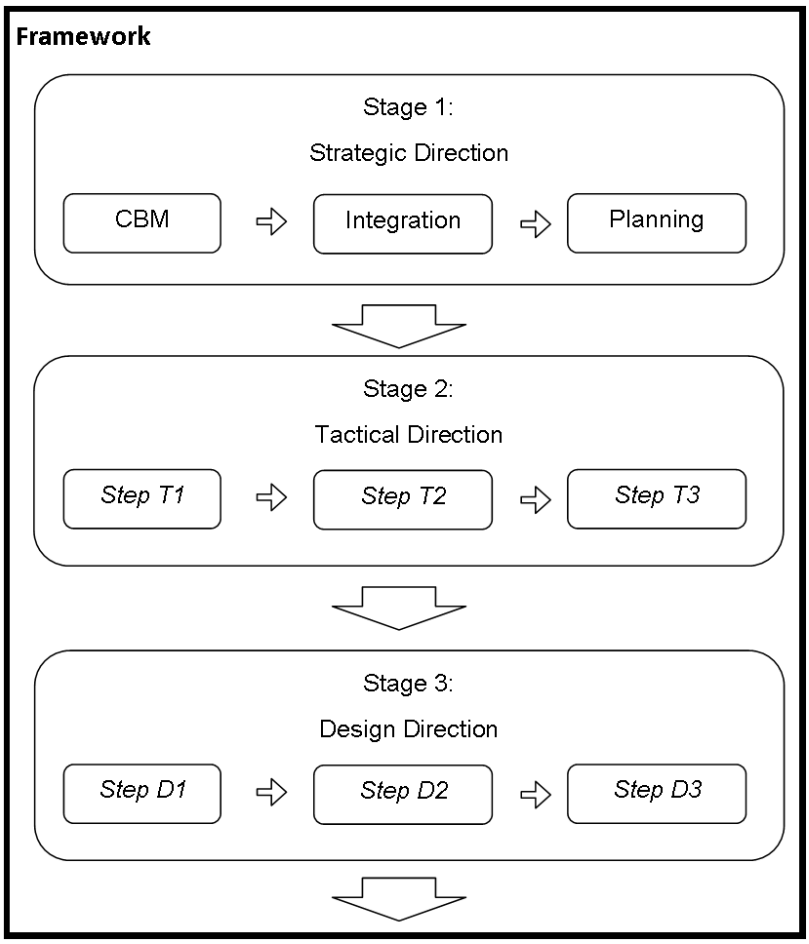

Figure 8 Framework for products and services evaluation

minority of products and could to a large degree be captured under a catch all of societal benefits. Therefore the two axes / four grid matrixes assessment tool is proposed would consider the societal benefits against the environmental costs as illustrated in figure 9. The product with the least environmental cost and most social benefit is sitting in the most desirable position.

Step two: Integrating the CBM with economic data.

The 4-grid assessment is set up similar to the Boston matrix, and it is intended for the tools to be complementing the Boston matrix for strategic recommendations. The Boston Matrix or growth-share matrix was first developed by the Boston Consulting Group (BCG) (Boston Consulting Group 1970) to help companies decide on their internal investment and marketing strategies (which products and parts of the business should get the investment). This is important as a business has limited financial resources and so needs to allocate these such that the greatest business benefit is achieved. The two dimensions of a Boston Matrix are relative

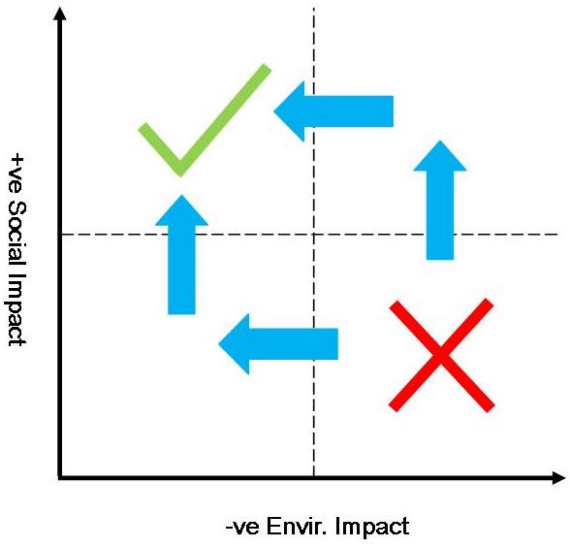

Figure 9 The cost benefit matrix

market share and market growth. The matrix is set up as illustrated in figure 10. The products are assessed in regard to these two dimensions. Products that have high market share and high market growth are described as "rising stars", as it has an established share and a growing market. Products that have matured and have low market growth can be "cash cows" or "dogs" where cash cows are yielding high profits from a high market share and dogs are not making good revenuers from a small market share. It is intended for the CBM to identify a product's performance in social benefits and environmental costs, and to integrate the results with the Boston Matrix for future plan and action.

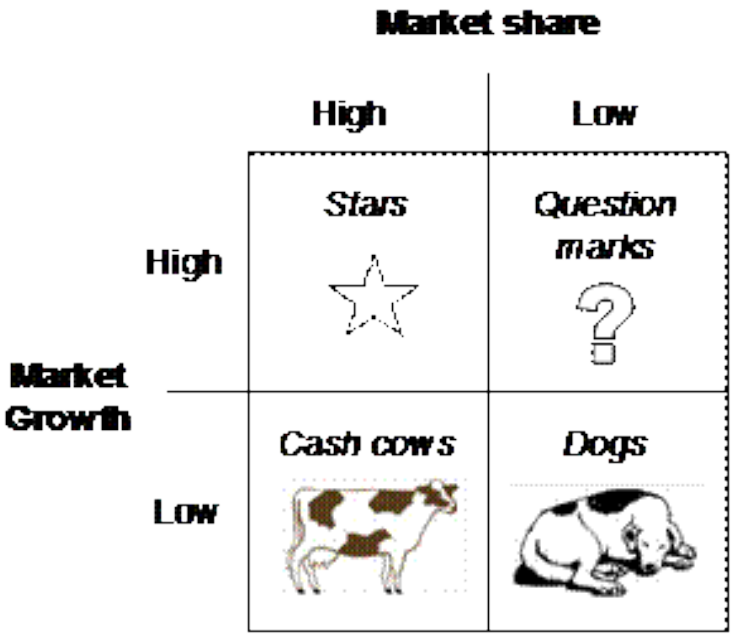

Figure 10 The Boston Matrix

Step three: interpretation and planning (resource allocation/ prioritisation)

Along with the positioning for the Boston Matrix, interpretations and recommendations will be provided in order to progress into the next stage of the framework where tactical details are drawn for operations planning.

In summary, the framework proposed in this section sets out the foundations of a systematic approach to supporting companies in this regard at a strategic, tactical, and operational level. The components for a strategic positioning and planning tools are described in the form of CBM and its integration with the Boston Matrix. Upon interpretation of the results from the two matrices, recommendations for tactical planning are provided in order to progress to the next stage of the framework.

4.0 Conclusion and further work

This current trajectory of increasing consumption and diminishing resources, and the noticeable effects of human activity on the environment make it inevitable that substantial environmental, social and economic changes will be required. One consequence of this may be a move from access to resources based primarily on financial capacity (cost), to one of demonstrable social importance (value). In this alternative economic model, companies who can demonstrate the social value and environment credentials of their products, services, and/or operations will receive priority access to these resources (rationing).Whilst economic decisions are well supported by a plethora of commercially available tools and techniques, and environmental decisions are, to a lesser extent, also supported but primarily around negative impacts (environmental cost), social decisions are limited to very specific issues (child labour, customers' privacy), primarily negative impacts. In order for companies to improve their resilience to a resource constraint future, new tools, methods and techniques are required that enable the evaluation of the company and its products and services, in terms of their societal benefits against their environmental costs. The framework, as presented in this paper, sets out the foundations of a systematic approach to supporting companies in this regard at a strategic, tactical, and operational level.

4.1 Further work

- Continue development and detailing of the framework for each of the three levels Identified and the specific application of this within the toy industry.
- Identifying and detailing the specific activities that require support

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