Incorporating Product Development Tools in Environmental Management Systems (EMS): A New Way for Sustainability Management

(Polin Kumar Saha, Senior Research Officer at Bangladesh Centre for Advanced Studies (BCAS) Dhaka, Bangladesh. E-mail: polin.msls2009@gmail.com, pol_du@yahoo.com, polin.saha@bcas.net, Skype: polin.kumar.saha)

Abstract: In recent years' business has been viewed increasingly as a major cause of social, environmental, and economic problems. Incorporating EMS tools to business can be initiative to solve this problem and raise the environmental awareness in the corporate and manufacturing sector. This management tool established suitably as an administrative tool to address continuous process in total management initiatives in the respective sectors. Even it is well known that EMS renders a robust contribution to the global environmental management, but some studies criticize the ultimate efforts. Their argument is that the EMS can only achieve partial management goals of the organization rather than entire target. So, it's not yet conceived as a key toolkit to achieve sustainability in industrial scale. This study aims to configure the vision of EMS through some innovative product development tools that could be integrate into the existing EMS platform, more specifically in the 'planning' division among all five segments of the EMS. Two approaches through 'Template for Sustainable Product Development (TSPD) and Strategic Life Cycle Management (SLCM)' incorporating the backcasting from sustainability principles, have been used to scrutinize the product development system in an EMS user company. By using TSPD the current reality and envisioned future are find out through the three analytical points of view of a product, e.g. market needs, concepts and extended enterprise. On the other hand SLCM has integrated into TSPD all the way from raw materials to the ending of a product based on all sustainability principles. TSPD and SLCM could be used as strategic planning tool in the conventional EMS to guide the product development for achieving sustainability. Finally, this study reveals that the integration process of sustainability could be parallel to existing environmental management systems where some product development tools are supportive catalyst to develop the concept.

1. Introduction

These days, environmental management has been imposed as an obligatory function in an industrial management worldwide. To deal with environmental issues in the industry, several tools are now become known to practitioners of environmental management approaches. Among all kinds of such tools, Environmental Management Systems (EMS) has been emerged with a huge popularity in befitting role to the global environmental problems. Because of outstanding performances of these tools including EMS, it is now required to check the outcome of its success strongly, as how and on what levels the delivery services of these tools are managing sustainability problems for which they are planned for.

Environmental management supports on valuable 'functioning' of the system while sustainability entails far greater emphasis on 'impacts and indirect effects' (Roome 1998). In making policies and planning, all EMSs segregate socio-ecological sustainability from that of environmental management. Awareness of social sustainability from the environment is now an increased burden of many organizations, i.e. managing indirect impacts of incorporating social

responsibility under EMSs system requires the need for activation of parallel management system- corporate social responsibility (Robert et al 2007). Hereby it is also significant to mention that environmental policies articulated by these EMSs systems are not intending to manage sustainability, but ambitious by compulsion, statuary requirements, or may plan at public relation (Hillary u.d.).

However, based on the literature, it is assumed that traditional ISO 14001:2004-EMS supports environmental management system- not sustainability. Hereby, all branches of socio-economic dimensions which are not included in the existing EMS, but to ensure sustainability it must be integrated in EMS (Roome 1998). To introduce sustainability and for ensuring its objectives, environmental management cannot be done on informal basis while it should measure the progress of socio-economic factors of which are really formidable entire the organizations. Considering the popularity and its industrial outreach, there is no way to ignore the systematic approach of ISO 14001 EMS (GEMI 2006), as it is also a comprehensive and administrative structure of environmental management (Robert et. al. 2007). So the standard can be turned to sustainability management rendering some strategic tools (Macdonald 2005).

ISO 14001

ISO 14001 EMS is 'star standard' among all environmental management standards of ISO series (Hillary u.d.). The number of ISO 14001 users is being increased steadily (Ammenberg and Sundin 2005). Present facts of ISO 14001 are as follows:

- About 155 countries around the world use ISO 14001 EMS
- Approximately 7,200 organizations use ISO 14001 in North America
- More than 188,000 organizations use ISO 14001 worldwide
- 70% of the users has been increased from 2004 to 2008, as it is more than 77,000 organizations

(QMI-SAI Global 2010)

As the purpose of ISO 14001 EMS, it is used in all kinds of organizations- manufacturing industry and service sector both (Stephen 2001). In comparison with other management tools, EMAS is site specific which is used for only manufacturing sector.

ISO 14001 EMS is used in organizations to take initiatives for environmental aspects, to utilize its own resources, adapt its own targets, commit for continuous improvement and promote awareness on employees. It works on the positive motivation and turns away from the policy of the punishment for errors (Cascio et. al. 1996). Considering the systematic performance, the generic structure of EMS ISO 14001 has been categorized into five major sectors of its operation, as follows.

The main processes of EMS are defined in the diagram below.

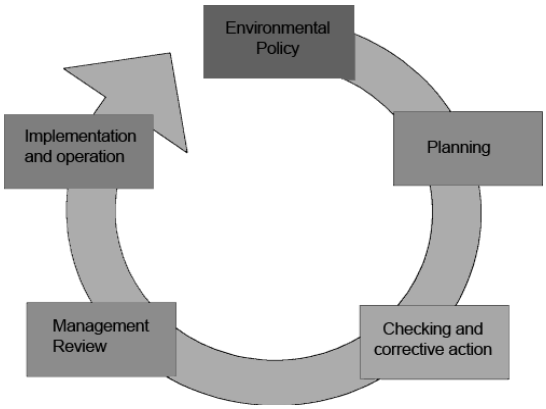

Fig 1: The generic model of ISO 14001 systems

Scope

Integrating sustainability in conventional EMS requires some significant changes in the 'planning' division out of five functional sectors of EMS. The study introduces 'Backcasting successes from principles of sustainability' as a very useful platform for sustainability planning that may guide and shift the planning mechanism of existing EMS towards sustainability. The planning mechanism of EMS can be done by some planning services incorporating backcasting i.e. Templates for Sustainable Product Development (TSPD) and Strategic Life Cycle Management (SLCM). These tools 'TSPD and SLCM' are so called product development tools which may multidisciplinary services to manage sustainability in the required system.

Considering the research problems of EMS issues, the study has drawn a research questions which is to know about the guidance for integrating product development tools in the conventional EMS. The study also expects in its new findings for the contribution towards sustainability with overall EMS services simultaneously.

2. Methods

2.1 ABCD Process:

In the process for backcasting from fundamental principles for sustainability, a strategic tool 'ABCD' has been used. The ABCD has four steps which help an organization to illustrate its own conclusions from sustainability principles. Therefore, the process of ABCD gives out the information for learning, investigation, build-up vision, design of program and leadership (Holmberg and Robert 2000).

Sustainability Principles (SPs): Towards a sustainable society nature is not subject to systematically increasing…

I. *…concentrations of substances extracted from the Earth's crust,*
II. *…concentrations of substances produced by society,*

III. *...degradation by physical means*

and, in that society...

IV. *...people are not subject to conditions that systematically undermine their capacity to meet their needs.*

(Robert et al 2007)

A funnel metaphor has been demonstrated in the following figure that how the existence of humanity could move in the sustainability planning based on the basic principles.

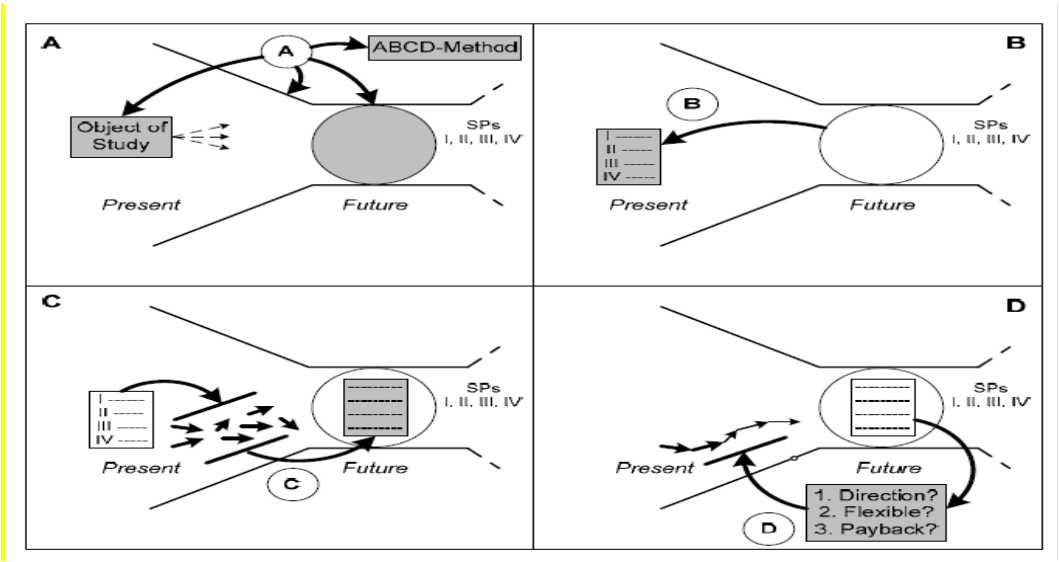

Figure 2: ABCD process. Backcasting from the sustainability principles (Ny et.al. 2006)

Awareness - A

At this stage, a collective linkage is directed around the sustainability. In the required system, or an organization, some direct and indirect impacts are observed in relation to sustainability. The required contents for understanding in this step are also executed from the five-level-framework used to check EMS sustainability (Saha and Seal 2011), which also outline the link between existing activities and supposed sustainability problems.

Baseline - B

In terms of analytical point of view of organizational operation, baseline information is seen through the lens of sustainability. The whole system including process products and management is analysed by four sustainability principles, SLCM and TSPD. In the process of this assessment, any type of others tools e.g. SWOT (Strengths, Weaknesses, Opportunities and Threats) can be helpful for taking the future initiatives.

Vision Future – C

The vision for sustainable society considers the entire the organization and its final product, or services. To create a sustainable vision, methodological approach in B step (e.g. SLCM or TSPD) would turn into the organization with backcasting success from the sustainability principles.

Prioritizing Actions - D

A business case is considered in this step, which was also defined by Willard in 2005. Among all the initiatives for sustainability management a set of prioritized actions are measured and implemented with time frame as well.

2.2 The Case Study - Hammarplast AB

A leading plastic manufacturing company in Sweden 'Hmmarplast AB' is taken into the case study for the observation of EMS operation. Company has been established in 1960 and it has currently more than one hundred employees in different manufacturing unit. As the basis of raw materials for production, the company uses plastic (Polypropylene) objects. For making different products the company applies injection moulding in the main manufacturing process.

2.3 Analysis and Recommendations

In the integration process for sustainability in environmental management systems, the following TSPD analysis has been introduced. To guide the strategic sustainable development (SSD) through the EMS application, the TSPD is further guided by SLCM and ABCD (mentioned above) tool.

2.3.1 Interviews

The study uses qualitative data in the analysis. In this process of qualitative data collection, the activity involves with interview (face-to-face and over phone), visiting industry, various web-based information and peer reviewed journal as well. Interview questions are directed by the sustainability principles aiming to the performances of environmental management systems (EMS) entire the organization.

2.3.2 Template for Sustainable Product Development - TSPD

TSPD is a modern version of the Method for Sustainable Product Development (MSPD) that is used in case of all un-sustainability practices in the organization (Hallstedt 2008). Most importantly, this method is very useful in the process of continuous dialogue among different stakeholders of an organization (Ny et al 2006). TSPD is used to categorize product development outcomes in relation to the sustainability benefits, or problems and strategic solutions of those assessments.

Questions regarding sustainability management in line with the current concept of the product (B-step) and a sustainable future (C-step) have been asked in TSPD process. In this process A-step of A-B-C-D approach can be done independently, while D-step depends on the outcome of

B and C step analysis of the TSPD. So, a set of priority actions follow which steps for EMS planning, are shown in the following TSPD structure.

Table 1: Templates for Sustainable Product Development. Source: (Ny et. al. 2006)

	Template B1: Market Desire/Needs	Template B2: Concepts	Template B3: Extended Enterprise
'B' of ABCD Current Reality	What *current* market desire does the product intend to meet? What are some *current* sustainability challenges related to this market desire? How does this market desire relate to human needs?	From a full life-cycle perspective, how is our product from a sustainability standpoint *currently*? What *current* flows and management routines from the life cycle of the product are critical from a full sustainability perspective? What *critical violations* of the sustainability principles could be identified for the following general life cycle phases? - Resource extraction, supply chain & manufacturing - Distribution and use - Final disposal or reuse/recycling/land filling **(SLCM tool is helpful here!)**	What *current* preferences of societal stakeholders are opposing the introduction of more sustainable products? If/how is the company trying to change these? What *current* value-chain cooperation is agreed upon and what gaps exist that prevent responsible handling of sustainability problems?
	Template C1 Future Market Desire/Needs	**Template C2 Future Concepts**	**Template C3 Future Extended Enterprise**
'C' of ABCD Future Opportunities	What *new* market desires are likely to evolve in the future as responses to sustainability challenges? What *new* market desires (related to our core business) could improve the chances of satisfying human needs? Are there any market trends that point in this direction?	What improvements can we make to our current products' life cycles to reduce its contributions to violations to sustainability principles? (Could the physical flows, management routines, etc. related to the *current* life cycle of the product be developed to reduce the risk of societal violation of the basic sustainability principles? What solutions to product-related sustainability problems could be identified for the general life cycle phases listed above?) Could *new* product concepts be developed to meet current and/or future market desires while reducing the risk of violation of the basic sustainability principles?	What *future* societal stakeholder preferences would be favourable for the development of more sustainable products, and how can we interact with those stakeholders to facilitate such change? What *future* strategic product value-chain cooperation would be favourable for responsible handling of sustainability problems throughout the life cycle? How can we develop such cooperation?

2.3.3 Strategic Life-Cycle Management – SLCM

Overall Process

SLCM is an advanced technique for strategic decision making. The application of SLCM provides information for 'B Step' that produce sustainable solution on C Step through brain-storming process, which ultimately leads to the priority measures for sustainability action on D Step (Ny et al 2006). All sorts of these outcomes of SLCM are further used in the Template 2 of TSPD.

SLCA Process Stages
1. Overall process
2. Scope/goal definition
3. Process Mapping and Inventory Analysis
4. Impact Assessment
5 Interpretation and Improvement Assessment (i) Option generation (ii) Option analysis and option choice

Fig 3: SLCA Process Stages source (Ny et. al. 2006)

Scope/Goal Definition

As the case study, a plastic product of Hammarplast AB is used in the study to set up company's scope/goal and the procedure, which is applicable in the same way for other products for any industry.

Process Mapping and Inventory Analysis

In this process life cycle assessment of a product is conducted to identify 'hot' areas of the product as reported through sustainability violations based on 4 (four) sustainability principles. Outcome regarding substitution and/or dematerialization of product raw materials is the ultimate efforts in the inventory analysis.

Table 2: Strategic Life cycle Management (SLCM) Tool

	Sustainability Principles (SPs)			
	SPI: Materials from the earth's crust	SPII: Substances produced by society	SPIII: Physical degradation of earth	SPIV: Human needs
Raw Materials				
Production				
Packaging & Distribution				
Use				
End of Life				

Impact Assessment/ Analysis

The intensity of the socio-ecological violations and damage is analysed in against with the results from the above table.

Results Interpretation and Improvement Assessment

Result interpretation is handled for a new option towards sustainability while a difference between more-sustainable and less sustainable, or more un-sustainable and less un-sustainable is considered for suggestive improvement assessment in the process of life cycle (Ny et al 2006).

3. Results

3.1 Templates for Sustainable Product Development

Outcomes of TSPD analysis look like in the following section based upon interview, literature review and the brainstorming process.

Stage B: Current Market Needs/Desires – Template B1

In order to achieve a sustainable future, the first template is found with a rigorous planning platform for the EMS complexity (Roozenburg and Eekels 1995). The information relating product development requires the fundamental needs of human (also human choices) in this template, which helps organization to assess the sustainability issues between an organization

and human behavior (Redclift 2000). The 'satisfier matrix' (Max Neef 1991) and inclusion of human need are found in the template B1 in which the organization can rethink about the customers from different points of view.

Template B1: Current Market Needs /Desires
Understanding and evaluation the template on the following issues: *A. Current market desires and intend of the product to meet human needs* *B. Current sustainability challenges related to this market desires* *C. The level of human satisfaction related to the market desires*

Stage C: Future Market Needs / Desires – Template C1

Knowing the relationship between the product and concrete customer needs, template C1 helps organization for its future product planning in relation to human satisfaction and market desires. However, switching to services for better proposed option cannot give guarantee environmental solutions instantly (University of Minnesota 2006). For example, continuous dematerialization, or energy saving is done through the EMS approach.

Future Market Needs / Desires
Understanding and evaluation the template on the following issues: *A: New market desires are likely to evolve in the future as responses to sustainability challenges* *B: New market desires (related to our core business) improve the chances of satisfying human needs* *C: Options for other market trends in this direction*

Stage B: Current Products – Template B2

SLCM is applied here. Brief details are in the next section. The sustainability principles are upfront in the application of the strategic life cycle assessment of the product of Hammarplast. SLCM did not serve to determine not only the supposed violations of a product, but also inspected each activity for product development, no matter of insignificant or significant of its impact on the society.

Template B2: Current Products
Understanding and evaluation the template on the following issues: *From a full life-cycle perspective, the product covers the following points from a sustainability standpoint currently* - *Resource extraction, supply chain & manufacturing* - *Distribution and use* - *Final disposal or reuse/recycling/land filling.*

Stage C: Future Products – Template C2

As the existing EMS is not sustainability planning tool (Robert et.al 2007, Macdonald 2005), so, an integration of sustainability in the EMS planning platform requires some significant changes

regarding product manufacturing that recommended by the template C2. The concept of Current product helps organization to move how environmental aspects can be integrated with the concept of future products in aiming to constitute a single platform of social and ecological management equitably.

Brainstorming session is included to identify various steps which might be taken to reach at sustainability. To grow future product ideas, customer oriented sustainability agenda, brainstorming ideas and the sustainability planning run counter to each other (Larsson 2007), which is scatted in the conventional EMS.

Template C2: Future Products
Understanding and evaluation the template on the following issues: *A: Improvements that we can make to current products' life cycles to reduce violations to sustainability principles (The physical flows, management routines, etc. related to the current life cycle of the product be developed to reduce the risk of societal violation of the basic sustainability principles. Product-related sustainability problems are identified for the general life cycle phases listed above)* *B: New product concepts are developed to meet current and/or future market desires while reducing the risk of violation of the basic sustainability principles.*

Stage B: Current Extended Enterprise—Template B3

A dialogue process among different stakeholders and their useful communication mechanism facilitate organization in promotion the leadership for sustainable development (Robert et. al. 2007). Stakeholder knowledge is enforced positively in this template. Negative consequence for segregation of stake holders (Andersson and Wolff 1996), increased awareness of the customer pressure or discourage about sustainable development, working with the stakeholders (NGO's) for securing market image (Bansal and Bonger 2002)—are the part of extended enterprise.

Template B3: Current Extended Enterprise
Understanding and evaluation the template on the following issues: *A: Current preferences of societal stakeholders are opposing the introduction of more sustainable products.* *B: Current value-chain cooperation is agreed upon and what gaps exist that prevent responsible handling of sustainability problems.*

Stage C: Future Extended Enterprise – Template C3

Future extended enterprise is determined in the form of right infrastructure and identifying right steps for the sustainability. Social support from prospective stakeholders is inclusion in the organizational understanding towards future product planning (Peter et.al, 2007) while multiple sources of evidence is incorporated to validate decision making (Beckman 2007).

Template C3: Future Extended Enterprise
Understanding and evaluation the template on the following issues: *A: Future societal stakeholder preferences would be favourable for the development of more sustainable products, and how we can interact with those stakeholders to facilitate such change*

B: Future strategic product value-chain cooperation would be favourable for responsible handling of sustainability problems throughout the life cycle. Development of such cooperation.

Finally, the current reality of the product, which is an effort through six templates of the TSPD using 'backcasting from sustainability principles', could integrate the sustainability concept into planning step of environmental management systems.

3.2 Strategic Life Cycle Management -- SLCM

SLCM results in the template B2 and C2 provides a strong understanding about the sustainable product. Any organization can be facilitated by this approach of product development with the SLCM. The key findings are as follows through different stages of this tool while the plastic product of Hammarplast is selected for the analysis.

Processing of Raw Materials

Polypropylene is the most popular raw material for plastic products which has been used in Hammarplast AB. Around 4% of the global oil production is used to produce this Polypropylene (PP) while oil driven product is the sole source of this raw material (Plastic Europe 2007). The annual production of raw plastic pellets is 250 billion pounds approximately worldwide (Leahy 2004). Hereby, oil driven products are the result of synthesis of oil mining which is documented for the first step of producing plastic raw materials.

On the subject of plastic raw materials, sustainability violations are occurred in the form of extraction of raw materials, processing, transportation and socio-ecological impacts of mining. In the sustainable product analysis, it is identified some major violations of these activities in producing raw materials based on 'backcasting from sustainability principles'.

Sustainability Principles 1:

1. *Mining of the fossil fuels to produce raw material—polypropylene.*
2. *Mining heavy metals like ferrous, copper for production of machinery and processing equipment*

Sustainability Principles 2:

1. *CO_2, N_2O and CH_4 are produced during mining operation and O_3, CO, CO2, NO_x, Diesel PM and HC are produced during transportation (Agent of Climate Change). N_2O, SO_2, NH_3 are also produced and these are cause of acidification*
2. *Water: Solids, heavy metals, toxic compounds, Fe, NH_4+ levels are decreased, PO_4+, SO_4-, Cl-, HCO_3-, K+, Na+ levels are increased in organic matter*
3. *Soil: Acidic compounds, toxic metals, dissolved products, solid waste*

Sustainability Principles 3:

1. *Land degradation (Soil erosion, soil structure loss, nutrient depletion, soil acidity and rucksack*
2. *Water quality (quality parameter affection, nutrient reaching, swamp formation, acidity, Stalinization, loss of aquatic habitats)*
3. *Biodiversity (agricultural damage, deforestation, loss of species in surface and ground level)*

Sustainability Principles 4:

1. *Health: Humans are affected by chronic diseases directly via food chain through water and agricultural land, safety measures at the time of work in mining process*
2. *Social: Employment biasness, human rights in the work environment, child labour, overall impact of climate change on societal life*
3. *Power politics—war for energy resources*

Production

Hammarplast applies a process of injection moulding to formulate around hundred types of the products. The working condition in the plastic product manufacturing is a serious health issues among females (Forrest et. al. 1995). Major violations of sustainability principles in the production series are as follows.

Sustainability Principles 1:

1. *Net use of the mined materials , including oil, heavy metals, alloys, synthetic dyes in machinery construction and product make*
2. *Energy derived from the non sustainable resources like nuclear energy is used to run all the main/sub processes and development activities*

Sustainability Principles 2:

1. *Emission of the gases like hexane. Emission from the use of the energy derived from the non renewable materials*
2. *Use of catalysts and stabilizers. Use of pigments and dyes for paper printing*
3. *Use of the man made alloys in moulds. Iron and the copper are increasing systematically in environment*
4. *Use of the lubricants, hydrocarbon originated compound like pitch, grease and wax*
5. *Use of the synthetic dyes and persistent heavy materials*

Sustainability Principles 3:

1. *Use of the water resources in the moulding process. Water uses for washing purposes*
2. *Degradation of the natural resources as a result of the mining of hydrocarbons, metals and energy resources*
3. *Hydro electricity and nuclear electricity both contribute to systematic degradation of the ecosystem and resource depletion*
4. *Packaging materials and synthetic dyes*

Sustainability Principles 4:

1. *Health related issues owing to emissions of the gases during transport of materials and logistics*
2. *Infertility and reported health issues*
3. *Nuclear wastes require extra precaution to be disposed safely*
4. *Power from hydro electricity causes erosion of lands, displacement of people and loss of biodiversity*

Packaging and Distribution

Packaging and distribution controls overall life cycle impact of the products. Appropriate packaging of products may decrease the supply-chain cost of the products and waste disposal also (Oki and Sasaki 2000). Transportation is mainly responsible here as the main cause of sustainability violations. The analyzed agents of violations are given below:

Sustainability Principles 1:

1. *Mining of the fossil fuels to produce energy sources-petroleum*

Sustainability Principles 2:

1. *Air: CO, N_2O, O_3, Pb, HC, CO_2, Diesel PM produced during packaging manufacturing and transportation (Agent of Climate Change)*
2. *Soil: Acidic compounds increased due to acid rain in the industrial area. Soil nutrients depleted*

Sustainability Principles 3:

1. *Land degradation: Sludge disposal, soil structure loss, nutrient depletion and soil acidity. Pulp sludge destroyed the soil ecological balance*
2. *Deforestation for production of bio fuel*
3. *Biodiversity loss (agricultural damage, deforestation, loss of species in surface and ground level)*

Sustainability Principles 4:

1. *Health: Lung Cancer, heart diseases, Lung diseases, Asthma Attacks and other health problems caused by Air, water and degradation*
2. *Social: Ecological impacts influenced the sociological structure due to global warming and Ozone depletion*
3. *Power politics—war for energy resources*

Uses

The product is used in the analysis that has no significant environmental impacts during of its use for different purposes. But, at the time of cleaning of these plastic products, it may have some minor violations as per cleaning requirements. Detergent or amount of waters may interfere the life cycle of the product, which should be considered for 'sustainable product' requirements. Finally high volume of water-use depletes water resource and then the water treatment is required, which has become totally unsustainable practices.

End of Life

According to global statistics, plastic consumption has been increased from 5 million tons in 1950 to more than 100 million tons until 2007. The picture says that we are now producing 20 times more plastic than the amount in 50 years ago (Waste Online 2006). In comparison globally, the increased trend of plastic product production has been observed in Europe -- A 3% increased consumption is reported from year 2006 to 2007 (Plastics Europe 2008).

However, the major violations in this stage of product life cycle are given below:

Sustainability Principles 1:

1. *The transportation of the raw material to the waste lands through transport running on the fossil fuel.*

Sustainability Principles 2:

1. *Air: Green house gases (CO_2, NO, SO_2), aromatic hydrocarbons, CN, NH_3, HCl are produced during recycling and incineration*
2. *Emission of the gases of transport using non renewable energy*
3. *Use of the synthetic dyes and persistent heavy materials*
4. *Water: Solid waste*
5. *Soil: Solid waste and acidic compounds*

Sustainability Principles 3:

1. *Air quality degradation due to climate change*
2. *Land degradation when combusted products are disposed in to the soil*
3. *Landfills and dumping renders the declared areas ineffective for other human activities-- Biodiversity losses indirectly*
4. *Polluting the natural resources through gases dyers, papers*
5. *Choking the sewage systems and de materials and synthetic dyes -Destroying the marine life*

Sustainability Principles 4:

1. *Health: Humans are affected by chronic diseases directly via through water and agricultural land, safety measures at the time of work in combustion process and disposed of it*
2. *Health related issues owing to sewage*
3. *Emissions of the gases during transport of raw materials and its hazards*
4. *Loss of bio diversity, migration of the people from polluted places*

3.3 Discussion

Environmental Management Systems (EMS) is being demonstrated in the companies with a very positive attitude to manage environmental impact, but it fails in diversified management of many new environmental activities relating the issues (Arts and Morrison-Saunders 2004). The method of TSPD and SLCM incorporating sustainability principles could give robust conceptual thoughts about sustainability which might be used for strategic planning to recover existing gaps of EMS policy and planning. In this regard, a list of compelling measures of TSPD and SLCM analysis can play a vital role for decision making to move towards sustainability of an organization. Since, the given structure of EMS is considered as an administrative launching pad to promote sustainability (Robert et al 2007, Macdonald 2005), so it is strongly feasible in the flexible integration of sustainability into EMS while TSPD and SLCM is used for a very fundamental outlay of sustainability considering the product analysis.

Overall, the findings of study may influence the ISO EMS users to rethink about their approaches of environmental management systems that could be an initiative in one step advance towards sustainable development. For the integration process, the unique model of EMS has been influenced by product development tools as shown in following schematic diagram.

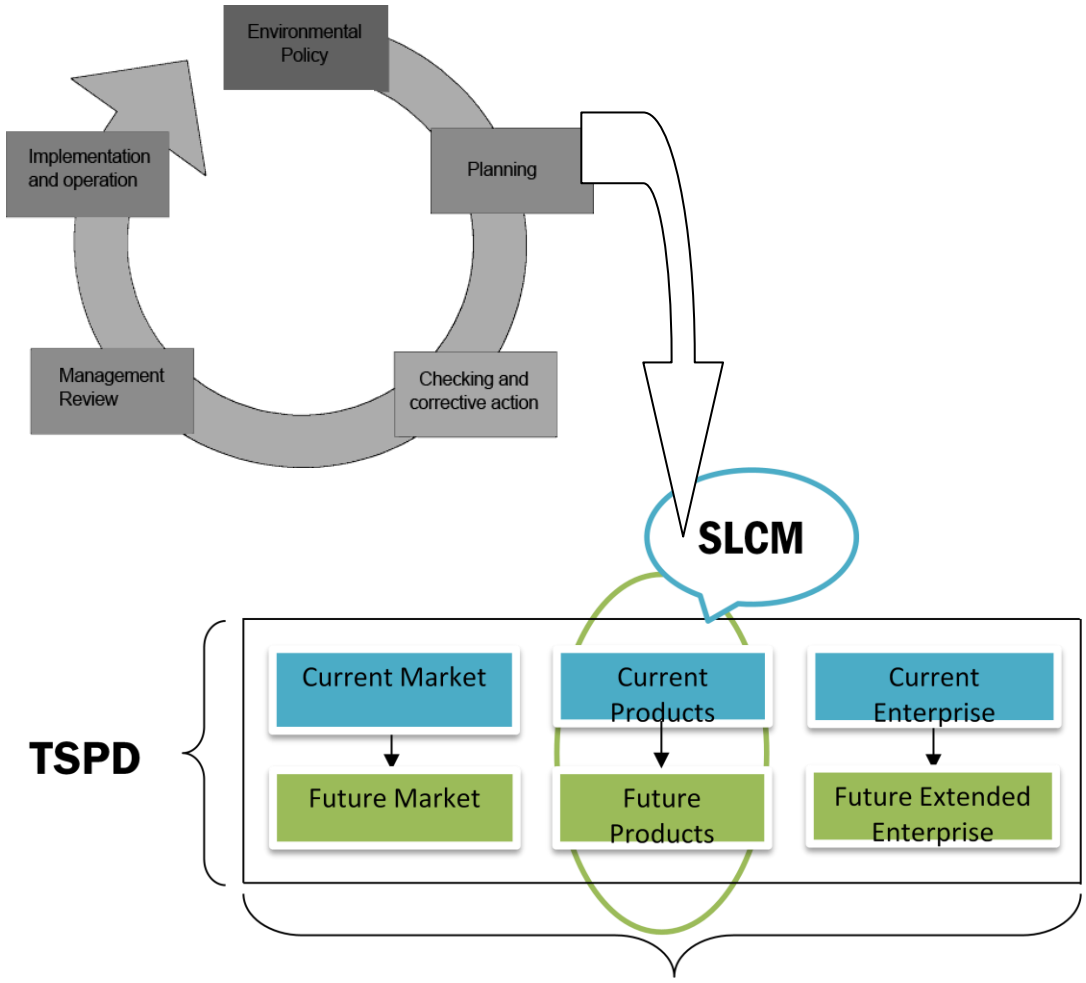

Fig 4: Use of the TSPD and SLCM as substitute to EMSs planning.

TSPD:

Stage B of TSPD – The Baseline

Measuring current reality (B) could help organization to be aware of sustainability gaps within the current products and management practices both. By analyzing the current reality of product, management team of an organization could understand that how these conceptual gaps concerning sustainability being translated and disseminated into un-sustainability.

Stage C of TSPD - The Envisioned Future

"Environmental issues are needed to be integrated into everyday thinking; decision-making, accountability processes and sustainable development should be considered in relation to every environmental problem" (Stefan et.al 2003).

At step 'C', backcasting from the sustainability principles could help organization to see a creative vision for sustainability beyond the horizontal technology and financial possibility of an

organization. By assessing ‘B’ Stage to ‘C’, the process helps organization to understand the possible sustainability settings in a more clear way.

Strategic Life Cycle Management (SLCM)

Life cycle analysis of a product by SLCM reports sustainability violations that gives the opportunity to organization for principle oriented improvement solutions. This way of improvement assessment does not mean that all initiatives would be exact and fast solution for sustainability problems, but introduces an influential vision which must be replicated precisely or partially to achieve sustainable future.

4. Conclusion

Study shows that the EMS has the main challenge to be integrated with sustainability, as it constraints theoretical or practical background of sustainability assessment e.g. four sustainability principles. No standard objective for the organization or products EMSs does have to guide organization, but its self defined objectives have given us to carry out this study. That is why; the study suggests about integrated EMS including some significant changes for stepping sustainability planning. An integrated EMS holds the “planning” mechanism apart of the conventional EMS, which might be guided by the concrete four sustainability principles i.e. SPs. To support in the changes of EMS, ‘self regulation’ of EMS approach can play a vital role to be integrated with some new regulations for continuous improvement with backcasting from principle of sustainability.

Simultaneously, the application of SLCM and TSPD may introduce by incorporating ‘backcasting’, which acts with a small initiative in any mechanism handling trades between un-sustainable and sustainable materials and/or practices. Therefore, the EMS systems can provide a fundamental infrastructure of an organization that plays a central role for sustainability management with the proposed approach systematically.

5. References

Ammenberg J. & Sundin E., 2005. *Science Direct, Products in environmental management systems: drivers, barriers and experiences.* http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6VFX-4BNVW8D-1&_user=644585&_rdoc=1&_fmt=&_orig=search&_sort=d&view=c&_acct=C000034638&_version=1&_urlVersion=0&_userid=644585&md5=65b23fa893a7c40382b52ed918 8ff9e7 (accessed March 28, 2012).

Andersson T. & Wolff, R., 1996. Ecology as a challenge for management research. Scandinavian Journal of Management, Vol 12.

Arts J. and Morrison-Saunders A, 2004. *Assessing impact : handbook of EIA and SEA follow-up.* Sterling, VA : Earthscan.

Bansal P. & Bonger, W.C., 2002. Deciding on ISO 14001: Economics, Institutions, and context.

Long Range Planning.

Beckman P., 2007. Value Creation Through Voluntary Sustainability Initiatives. Gotenberg, Sweden: School of Business, Economics and Law. Gotenborg University.

Cascio J., Woodside G. and Mitchell P., 1996. *ISO 14001 Guide: The New International Environmental Managment Standards.* MarGrah-Hill Professional.

Forrest M. J., Jolly A. M., Holding S. R. and Richards S. J., 1995. *Emission From Processing Thermoplastics*. www.sciencedirect.com (accessed 12 March 2012)

GEMI. "Global envionmental management initiatives, 2006. "*ISO 14001 Environment Management System Self-Assessment Checklist*. http://www.ofee.gov/ems/training/GEMI%20Self%20Assessment%20Checklist.pdf (accessed 8 February 2012).

Hallstedt S., 2008. *A Foundation For Sustainable Product Development, Doctoral Thesis.* Karlskrona, Sweden: Blekinge Institue of Technology

Hammarplast, 2005. Quality and Environmental Policy. http://www.hammarplast.com/filearchive/1/1999/Environmentalpol.pdf (accessed 29 Janruary 2012).

Hillary R., ISO 14001 -- Case Studies and Practical Experience. GreenLeaf Publishing.

Holmberg J. and Robert K. H., 2000. Backcasting from non-overlapping sustainability principals: a framework for strategic planning. International Journal of Sustainable Development and World Ecology7:1-18.

Larsson R., 2007. *Integrating Sustainablity with Business Strategy -- The Swedish Chemical Industry* . Stockholm: Stockholm School of Economics, Department of Marketing and Strategy.

Leahy S. 2004. *Drowing in an ocean of plastics*. http://www.culturechange.org/Petroleum&Plastics.html (accessed 11 April 2012)

MacDonald J. P., 2005. Strategic sustainable development using the ISO 14001 Standard. *Journel of Cleaner Production*, Vol 13.

Max-Neef M. A., 1991. Human Scale Development: Conception, Application and Further Reflections. The Apex Press.

Ny H., MacDonald J.P., Broman G., Yamamoto R. and Robèrt K.-H. 2006. Sustainability Constraints as System Boundaries. An Approach to Make Life-Cycle Management Strategic. Journal of Industrial Ecology, vol 10, issue 1-2.

Oki Y. and Sasaki H. 2000. Social and environmental impacts of packaging (LCA and assessment of packaging functions). Packaging Technology and Science, Vol 13.

Peter N., Hamprecht J., Hofstetter J.S., 2007. Supply chain design of voluntary sustainability initiative: Organization's strategic answer to an emerging societal discussion.

Plastics Europe, 2008. *The Compelling Facts about Plastics 2007.* Brussels: Plastics Europe.

QMI-SAI Global, 2010. ISO 14001 Environmental Management System Standards. http://www.qmi-saiglobal.com/registration/iso14001/Default.asp?language=english (accessed 30 June 2012).

Redclift M., 2000. *Sustainability, Life Chances and Livelihood* . London: Routledge.

Robert K. H., Broman G., Waldron D., Ny H., Byggeth S., Cook D., Johnsson L., Oldmark J., Basile G., Haraldsson H. & MacDonald J., 2007. *Strategic Leadership Towards Sustainability.* Karlskrona, Sweden: Blekinge Institue of Techonology.

Roome N. J., 1998. *Sustainability strategies for industry: the future of corporate practice.* Island Press.

Roozenburg N.F.M. and Eekels, J., 1995. Product Design, Fundamentals and Methods, Wiley, Chichester, UK.

Saha P. K. and Seal L. 2011. A Strategic approach to Environmental Management Systems (EMS): An assessment of sustainability in EMS to move toward sustainability. International Journal of Environmental Sciences, Vol 2, issue 2.

Stefan S., Burritt R. and Petersen H., 2003. *An Introduction to Corporate Environmental Management -- Striving For Sustainability* . Sheffield: Greenleaf.

Stephen T., 2001. *Environmental Management Plans Demystified: A Guide to Implementing ISO 14001.* Taylor & Francis.

University of Minnesota, 2006. *Shift toward toward service-based economy won't end global warming*: www.news.mongabay.com/2006/1101-economy.html (accessed 13 April 2012).

Waste Online, 2006. plastic information fact sheet. http://www.wasteonline.org.uk/resources/InformationSheets/Plastics.htm#_Types_of_plastic (accessed 3 April 2012)

Willard B., 2005. *The Next Sustainablity Wave.* Gabriola Island: New Society Publisher.