

## Ecodesign in developing countries Example of the re-design of a backpack in the fiji islands

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► Small Islands Developing States (SIDS), including the Fiji Islands, face serious economic, social, as well as environmental challenges. Their peculiar situation requires carrying out different approaches from the ones usually used in continental and developed countries. This project has been, as far as we know, the first application in an SIDS of an initiative about cleaner manufacturing and design using the D4S methodology (Design for Sustainability) developed by UNEP: a new backpack with better environmental performances in the Fijian context (leading to less residual and hazardous wastes along its life cycle), has been designed, manufactured and marketed locally, with an adapted environmental advertising. The project has also contributed to enrich the D4S method by proposing a relevant articulation with the life cycle assessment method (LCA, standardized by the ISO 14040). A method to gather adapted life cycle inventory data and to propose hierarchical organization of the impact categories has also been developed.

Consisting of 110 inhabited islands and a total land area of 18,274 km<sup>2</sup>, Fiji, though it is the largest SIDS in the South Pacific, is much smaller than its Australian and New Zealander neighbours. Because of their peculiar situation, the Fiji Islands face specific issues in addition to the ones encountered by the other developing countries. With a population mainly concentrated in the coastal areas, these island states will be heavily affected by climate change and sea level rise. Besides, they are confronted with problems due to their lack of economy of scale and remoteness.

In addition to climate change, one of the main challenges for these countries is solid waste management. Indeed, over the last 15 years, and because of increasing urbanisation, waste production in Fiji grew dramatically while treatment possibilities remained insufficient for the most part. That is why, additionally to the classic life cycle approach in ecodesign, peculiar attention has been paid, during this project, to the management of production wastes and end-of-life scenarios for the ecodesigned product.

Although solutions such as sanitary landfills or waste water treatment plants are increasingly available in SIDS, cleaner production initiatives are still in their infancy. While ecodesign has become popular in Europe, Japan, or Australia, it is still weakly addressed in developing economies. To address the deficiencies in ecodesign adapted to developing

economies, the United Nations Environment Programme (UNEP) sponsored the development of a publication by the University of Technology of Delft that provide a simple step-by-step methodology, called Design for Sustainability (D4S). This methodology focuses on the needs of SMEs specifically in developing economies. D4S adopts a practical approach to sustainability by assessing the needs of these enterprises and providing the necessary tools to improve their products.

The project carried out by G-SCOP and its partner the University of the South Pacific in a medium-



sized company operating in Fiji, the Cook Islands, and Samoa, focused on the improvement of an existing product, a backpack, and the related life cycle in order to make it more environmentally friendly to manufacture, sale and dispose.

project outcomes revealed that D4S provides a suitable tool for a country like Fiji to pursue more intensively an eco-friendly manufacturing agenda. However, when combined with LCA, the qualitative

*«A progressive world where innovative technologies and services are eco-designed and eco-used in a socially-, economically- and ecologically-responsible industrial ecosystem»*

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Design, Industrial engineering, eco innovation, environmental database, sustainable development, eco-design, Life cycle, LCA, reuse, remanufacturing, recycling, REACh, product service system, energy efficiency, material flow, closed-loop production, environmental assessment, environmental indicator, recycling rate, management of hazardous substances, system innovation, functional sales

The Eco-design research centre is member of:

Since 2005, the centre has welcomed more than 50 researchers.

At present, 8 graduated and 10 current PhD students

### Running projects

▶ ANR/ADEME Eco-Use, ANR Convergence, ANR Skippi, FUI Senscity, ADEME Synergico, AUF Conception pour la Durabilité, Eco-industrie GIPIE2.0, Région nano2012 et à la plateforme européenne VISIONAIR.

### Partners

▶ ADEME, AUF, Fondation CETIM, EVEA, CODDE, BIO-IS, Groupe SAFRAN, Orange, STMicroelectronics, Renault Trucks, SAGEM Communication, NEOPOST, Dassault System, Chanel, Schneider Electric, ... .

▶ EPF Lausanne, Cranfield, Linköping, DTU, Strathclyde Glasgow, Loughborough, T.U Braunschweig, Kaiserslautern, Bochum, Unicamp, UFT Parana, USW Sydney, KMUTNB Bangkok, USP Fiji, CfSD, ... .  
Supmeca Toulon, UT Troyes, Arts et métiers Paris Tech.

### Networks

▶ CIRP LCE, IPSE.  
▶ ARDI, Viameca, Arve-Industries, Minalogic, System@tic.

nature of D4S shows that not all solutions produce the best overall result. Specifically, the "improved" design, whilst being less impactful on Fiji in terms of disposal, has a higher impact globally due to the production and manufacture of the new materials used. For this reason designers need to address the impact criteria and decide whether a domestic or international agenda is of greater concern within the SIDS context.

### Results

Three types of benefits (« planet, people, profit ») from the redesign of the backpack have been identified:

#### Planet benefits

The change from polyester to a vegetal material (cotton) first, and then to an organic fiber after the cotton canvas was revealed to have a high impact thanks to the product life cycle assessment enabled to replace the original material by a renewable fiber and, which is likely to be biodegradable and less toxic when incinerated, and to eliminate agrochemicals and to limit the impacts to the environment and wildlife in the growth phase of the cotton crop. However, due to lower productivity, it also has the added impact of increasing the amount of water consumed compared to normal cotton.

The oil based paint was replaced by a water based paint thereby reducing hazardous waste problems, improving employee working conditions, and reducing the impact at the backpack end-of-life.

Some factory-centred improvements such as an energy savings policy, increased paper recycling and safer working conditions were all positive results of this D4S project and impacted positively the product. The amount of packaging used for the distribution stage of the product was reduced by 97%, again reducing waste.

#### People benefits

Thanks to the new backpack, the local company should become more profitable, thus contributing to a sustainable development of the local textile industry, which is of particular social importance in Fiji. Factory based benefits arise through the handling of less harmful paints, thereby improving working conditions and reducing the amount of hazardous waste, and the problems associated with storage, and disposal. The creation of the team within the factory also fostered a more inclusive design process integrating sections within the company thereby promoting life cycle thinking.

At the retail store consumers were exposed to a simplified environment product declaration promoting

the benefits of the newly ecodesigned backpack. This environmental information was extremely important in educating the consuming public to the environmental issues facing Fiji, and the world.

#### Profit benefits

##### *Cost of the backpack*

The cost of organic cotton was slightly higher due to its relatively limited supply, and in part due to relatively low yields. Costs were saved in the reduction of plastic packaging and also in the reduction in electricity used for assembly. Moreover, none of the new materials required new manufacturing techniques (sewing of cotton fabric, baking process for the new paint) and therefore posed no technical problems or major expenses. Consequently, no major increase in the backpack price was observed.

##### *A more marketable backpack*

The redesigned backpack was viewed by the company as a major selling point, differentiating their product from those of their competitors. This also provided the company with an avenue to develop a Fiji-made environmental product declaration that was written by USP and attached to the backpack highlighting the product's environmental performance.

The company also viewed the ecodesigned backpack as a new entry into the export market, with growing concern for the environment demonstrated by their customers, allowing them to pitch their product on levels other than price. The new backpack is also more attractive. The cream coloured cotton fabric provides greater flexibility for the application of different colour schemes that was not possible with the black polyester fabric. As a result, within the first few months of being launched the sales doubled compared to the polyester variant. Consequently, manufacture of the former version of the bag was discontinued.

##### *Applicability of D4S methodology in Fiji*

The D4S project is still ongoing, and the following two step strategy is currently being proposed by the University of the South Pacific: the D4S project should now focus on products to be exported to demanding markets (Australia, New Zealand, Europe, USA) or on products that can attract environmentally conscious tourists; sectors such as outdoor and beach textiles, and mineral water packed in PET bottles should be targeted first. Benefiting from the results of the first stage, the adapted D4S project should then extend its activity to products highly consumed by Fiji customers, for example local food products.

### ▶ Publications

WOOD, M.D., MATHIEUX, F., BRISSAUD, D., EVRARD, D., (2010), "Results of the First Adapted Design for Sustainability Project in a South Pacific Small Island Developing State: Fiji". Journal of Cleaner Production Vol.18(18), pp.1775-1786

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Mathieux F., Evrard D., Mataka M., Koshy K., Sustainability and adapted product ecodesign in Small Island Developing States of the South Pacific in Proceeding of CIRP LCE Conference 2008

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