

An ecodesign case study of the award winning TinyLab™

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Abstract

While the greatest concentration of ecodesign to-date has centred on large, international companies, SMEs represent a key element of national economies throughout the world, and they play a significant role in the development of new products. It has been well documented that ecodesign or simply good design is good business practice. This paper explores how one micro-sized Welsh business, Riochem™, is taking on the ecodesign challenge. With the support of Design Wales and a multi-stakeholder team, Riochem™ took an ecodesign-led approach in developing their award winning TinyLab™, a novel and innovative product and service for chemical titration analysis.

Keywords

SMEs, Ecodesign, Multi-stakeholder team

1. INTRODUCTION

It is well documented that companies are facing increasing pressure in relation to their environmental performance. These include pressures from regulatory bodies, trading partners and from the market. The key response has been the development of environmentally superior products/services and sustainability oriented brand strategies. In the last few years, many organisations have recognised the competitive advantage to be gained from environmental best-practice.

Integrating environmental considerations in the design phase allows companies to reduce their environmental impact in a more cost-effective manner than dealing with expensive end-of-pipe mitigation measures. Many companies have gained competitive advantage by incorporating ecodesign as a tool for reducing waste handling fees, improving stakeholder relations, exploring new market opportunities and proactive compliance.

To date, the greatest concentration of ecodesign activity has taken place in large companies. Many Small and Medium Enterprises (SMEs) do not recognise or understand their impact on the environment as they lack the financial and human resources to implement environmental strategies, ecodesign and environmental management systems. From the authors experience SMEs face a number of other barriers, including;

- a lack of understanding of the potential benefits of environmental improvements
- a lack of internal expertise
- a view of environmental activity as peripheral to the core business
- poor access to appropriate information
- an economic short-termism (i.e. the need for a quick payback on investments)
- initiative fatigue/overload (i.e. too many offers of support with questionable delivery)

From a sustainability perspective, SMEs represent a significant element of national economies through offering employment, harnessing entrepreneurial activity and creating competition. Some studies suggest that SMEs account for 65% of GDP, although this figure varies regionally [1]. SMEs have a significant impact on the environment and on the communities in which they operate. It has been estimated that SMEs account for over 50% of overall pollution from industry [2]. While company specific impacts may be relatively small and

outside the scope of national regulations, the cumulative impact of sectoral activities represents a significant challenge to sustainability¹.

Riochem™, a micro-SME² based in Wales, produces innovative instruments for chemical titration. With the assistance of a multi-stakeholder team, Riochem™ embraced ecodesign when developing their flagship product, the TinyLab™. This multi-stakeholder team included Design Wales, external design agencies (in particular GX Design Engineers), toolmakers and suppliers. Design Wales supported Riochem™ in the development of the TinyLab™ through an ongoing process of free support, advice, facilitation and mentoring. The product development process highlighted the many practical difficulties facing small businesses as they try to implement ecodesign. The TinyLab™ benefited from a wide variety of external support with each stakeholder playing a key role.

Financed by the Welsh Assembly Government (WAG), Design Wales provides free and independent practical advice on all aspects of design to SMEs, helping them realize and achieve their design-related objectives, while also providing strategic design advice to the WAG. Design Wales are currently developing a detailed proposal for a Welsh based ecodesign initiative tailored to the needs of SMEs. The objectives are to encourage and enable a long-term strategic approach to ecodesign in Wales [3]. This initiative will build on the experiences gained from working with SMEs such as Riochem™ to assist in the practical implementation of ecodesign in SMEs. Another key objective is to raise the ecodesign awareness within the business and environment support network through mechanisms such as the Electrical and Electronic Equipment (EEE) Focus Group³.

2. RESEARCH PROCESS

This paper is an intrinsic case-study of the TinyLab™. Design Wales revisited Riochem™ to conduct semi-structured interviews to review company specific drivers, barriers to the implementation of ecodesign and the

¹ Estimates suggest that around 91% of waste in Wales is produced by SMEs [2].

² A micro-SME is defined as a company of between one and ten employees.

³ This group focuses on strategic issues facing the EEE sector and has active participation from the public, private and community sectors.

difficulties that arose from offering a combination of eco-services in their sales and marketing strategy. A semi-structured interview with GX Design Engineers provided greater insight into how they integrate environmental considerations in their product development process.

3. THE PRODUCT - TINYLAB™

The TinyLab™ is an innovative and revolutionary approach to titration analysis. Utilising cartridges that contain high grade volumetric standard solutions, the TinyLab™ allows for on-site and lab-based titration analysis – even by non-specialists.

The product eliminates the possibility of cross contamination of chemicals, saves time and storage space. The product is also modular allowing for the incorporation of other probes for additional parameters such as pH, conductivity and temperature. Customers can purchase bespoke cartridges depending on their specific testing requirements.

Specification	Value
Model	Tinylab™ TL900
Length	125mm
Width	125mm
Height	235mm
Weight	359 g
Accuracy	±1 digit
Operating Temp.	- 10 to 60°C
Display	LCD Digital Display
Power	One 3V Lithium Battery
Battery Life	>5 years continuous use



Table 1: Product specification

4. DRIVERS FOR ECODSIGN

Riochem™ identified the commercial benefits of preempting EU Directives such as the Waste Electrical and Electronic Equipment Directive (WEEE) and the Restriction of certain Hazardous Substances Directive (RoHS). During the design stage it was not entirely clear if the product would be exempt from the RoHS legislation. The possible risk of the product being withdrawn from the market or the company being involved in expensive contractual disputes meant that pre-implementation compliance was the best option. A possible withdrawal of the product from the market is unacceptable for any producer. For a micro-SME it could mean failure of the business.

As one of the key markets for the TinyLab™ is the environmental goods and services sector it made commercial sense to include ecodesign alongside criteria such as cost and performance, strengthening the company's own sales and marketing strategy.



Figure 1: Sample page from the marketing brochure

As the product was to be sold business to business (B2B), supply-chain pressures were an important consideration. Environmental aspects are increasingly being included in the procurement specifications of large organisations. Even though the product was highly competitive through market distinction, Riochem™ had to be aware of likely future changes in customer specifications so they would be in a position to capitalise on them. Riochem™ recognised the added-value of implementing ecodesign.

Riochem™ is predominantly targeting large organisations and so had to be aware of the differing business culture and attitudes to the environment within different regions. While the product was highly competitive on factors such as cost and technical features, Riochem™ identified leverage in the products' environmental performance for certain markets.

5. BARRIERS TO ECODSIGN

Riochem™ faced similar barriers to most SMEs when trying to implement ecodesign. Due to financial constraints and a lack of time the product development team was restricted in their capacity to explore multiple design options, pilot investigations and R&D.

The company also faced a number of product specific barriers. The selection of materials was primarily guided by the technical properties required to handle the various chemicals and reagents that the product would come in contact with. This also restricted the ability to incorporate recycled materials in the product – due to the lack of recycled variants of these materials on the market.

The decision to use some off-the-shelf components, although offering a number of financial and potential environmental opportunities, placed restrictions on the product development process.

As with any small business the main focus was on cost and competitiveness issues. This made it difficult to establish long-term strategic objectives.

As this was a flagship product for Riochem™ they had no system to manage the knowledge and expertise within the multi-stakeholder team.

6. THE DEVELOPMENT OF THE TINYLAB™

Reflecting the situation in many SMEs, the process of designing the TinyLab™ was fragmented. Riochem™, at that time a sole entrepreneur, had no existing internal design capabilities or design management system. As the TinyLab™ was a flagship product for the company, the short-term priorities were predominantly focussed on getting the product to the market.

Riochem™ availed of a wide range of government support in the form of general business advice, financial support and design advice. With the intervention of Design Wales, the company were able to place greater structure on the product development process. This included defining roles and responsibilities, developing a design brief and identifying long-term product strategies. It was at this point Riochem™ began to look at the ecodesign opportunities extending from the original product concept.

7. MULTI-STAKEHOLDER TEAM

To assist in developing economies of scale many SMEs operate within collaborative networks. These networks allow SMEs to maintain competitiveness and to strengthen the company's position in the market. This means that, from an organisational perspective, SMEs are well positioned to regularly interact with a number of external stakeholders. The complexities of product development ensure that a micro-SME will be interacting with a wide number of stakeholders throughout the entire process.

Working closely with Design Wales, Riochem™ established an ecodesign strategy and a process to manage the interactions between the various stakeholders. Figure 2 outlines a basic model of the main stakeholders involved in the development of the TinyLab™. The model allows for quick identification of those stakeholders directly and indirectly involved. Those connected with a solid line are directly involved while those connected with a dotted line are indirectly involved. Even with this basic model we can see that there is significant cross-collaboration between the various stakeholders.

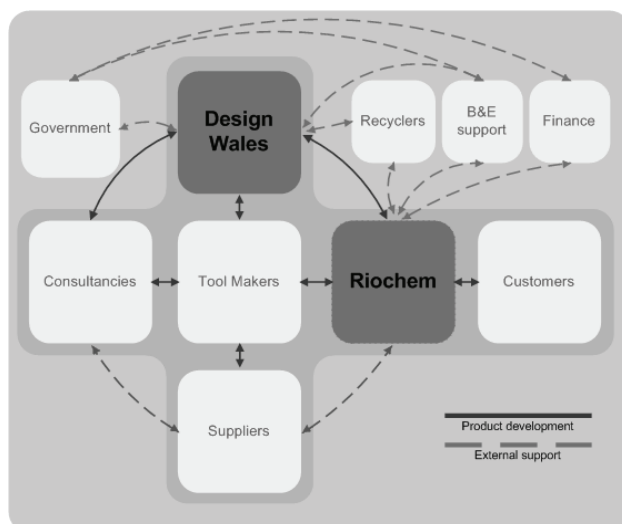


Figure 2: Stakeholder model in the development of the TinyLab™

8. INTEGRATION OF LIFE CYCLE THINKING

Any ecodesign strategy should have impacts on more than one stage of the product life cycle and ideally should improve the environmental performance at all stages. For example, the strategy should provide scope for reducing

use-phase environmental impacts and reducing production costs.

As is the case with many SMEs producing products, a full life cycle analysis was not possible due to budget restrictions. However, the steps that were taken to address the life cycle impacts included broad systems definition and identification of where ecodesign could make a positive intervention to improve the environmental performance of the product. This process of scenario building is enhanced with the involvement of a number of stakeholders with different specialist skills. This allowed for the development of a general product environmental profile which enabled Riochem™ to develop an awareness of the likely environmental impacts of the TinyLab™. This awareness allowed for management level commitment and support for action to be established. With clear strategic and operational goals, environmental issues could be treated as business issues. This environmental product profile was also of benefit for formulating the marketing strategy, strengthening customer relationships and setting future benchmarks.

9. ECODESIGN IMPLEMENTATION

In general, the use-phase of electronic products has the greatest environmental impact within the life cycle. This is due to the associated impacts of energy consumption, emissions and the use of consumables. The ecodesign strategy focussed on a number of key areas and was driven by specific requirements such as WEEE/RoHS compliance. This set down a number of guidelines such as a reduced material mix, ease of disassembly and repair, clear identification of materials and component recyclability. Design for disassembly can offer greater environmental gains than design for recycling as the reuse of the primary product with the replacement of components is less resource intensive.



Figure 3: Primary components

The enablers and drivers for implementing these types of ecodesign strategies are becoming more acceptable within industry as best-practice filters through the supply-chain. An increase in the knowledge of ecodesign techniques reduces any perception of risk that may exist.

There were a number of added benefits to the strategy such as having a high quality product which can be

refurbished or reused, disassembled parts that can be easily separated and recycled and multiple materials that can be separated into categories for reprocessing.

This extends the inherent value within the product, material and components. The economic imperative of extending the value cycle of materials is combined with the economic value of reducing reprocessing and recycling times.

Some of the greatest environmental gains for the TinyLab™ came from the use-phase management of chemicals (these chemical are essential to the process) – this includes chemical storage and cross-contamination issues.

Table 2 outlines the main steps taken to integrate environmental considerations in the development of the TinyLab™.

Stage	Ecodesign activities
(1) Planning	Riochem™ established communication with Design Wales. This initial contact opened discussion on project planning, defining roles and responsibilities and establishing a design brief. Possible ecodesign strategies for the product were discussed
(2) Conceptual	With the assistance of Design Wales and GX Design Engineers Riochem™ assessed the initial concept of a disposable vial. Through various iterative steps this concept was brought forward to a longer lasting product with a number of ecodesign attributes. The possibility of a Product Service System (PSS) was also explored at the conceptual stage.
(3) Detailed Design	During the detailed design stage ecodesign factors such as design for long life, component and material marking for easy recycling were introduced. The product was designed for ease of disassembly within strict industrial application parameters.
(4) Testing/ Prototype	During the testing and prototype stage Riochem™ incorporated product labelling such as the WEEE symbol. The product labels encourage the user to refer to the product manuals. The integrity of the product system was supported by a Failure Mode and Effect Analysis.

(5) Production	During the testing and prototype development stage Riochem™ made the transition to RoHS compliant components and lead-free soldering. Riochem™ has been utilising component re-use and direct recycling in the production process to keep costs down.
(6) Market launch	Riochem™ incorporated the ecodesign attributes in the marketing campaign. Factors such as WEEE compliance are given prominence alongside other product benefits such as cost and ease of use.
(7) Product review	Riochem™ has been reviewing the product from the perspective of future ecodesign opportunities. This review process has established benchmarks and strategies for future development work.

Table 2: Main ecodesign activities

It is clear that the process undertaken was very much company specific and this reflects the idiosyncratic nature of SMEs. The use of complex and prescriptive methodologies can hinder the implementation of ecodesign as they push budget restrictions to the limit and are seen as a restriction on lead times. This can be due to the resources required to undertake ecodesign training, especially in tools and methodologies that may not be tailored to the company's product or sector.

10. ECO-SERVICES

Riochem™ explored opportunities for a combination of eco-services. These included;

- An eco-efficient product oriented service arrangement involving training and product upgrades and servicing,
- An eco-efficient use orientated service involving a take-back scheme for the cartridges and product at end-of-life.



Figure 4: RioSol™ cartridges

The PSS would potentially reduce the environmental burden of the product throughout the full life cycle by reducing overall material intensity. This would also reduce overall production and procurement costs for the

cartridges. Riochem™ sought to build this opportunity into the sales and marketing strategy. The primary motivator for the company was the good PR opportunities and favourable customer relations from improved environmental and product performance. This added to the overall environmental orientation of the product's sales and marketing strategy.

For this system to work the customer/producer relationship would need to be strong, something which Riochem™ would favour. If the customer had a clear long-term purchasing strategy it is possible that the PSS could become a continuous relationship bound in a long-term contractual arrangement.

Being a small business, a number of administrative and financial constraints made it difficult to base the sales strategy solely on the PSS. Internal issues such as the cost of collection, storage and remanufacture can be difficult for any small business to absorb.

Also, there is no strong incentive on the producer or the customer to buy into such a scheme unless it is part of a contractual arrangement. Riochem™ identified difficulties in terms of the transfer of burden of storage to the customer.

As the primary customers are large organisations they are likely to buy cartridges in bulk. If there is no internal incentive to retain empty cartridges for return they are unlikely to do so. The opportunity for returnable transit containers for the cartridges was explored although the likely imbalance of usage patterns made this option difficult.

Riochem™ currently offers the option for a tailored eco-service to all potential customers. This sales option will be reviewed in the coming years to ensure that the PSS is appropriate to the needs of Riochem™ and their customers.

11. COMPLIANCE

Riochem™ have been working with their suppliers to ensure that the product will be RoHS compliant. This has added an administrative burden on the company although it has improved stakeholder communication. Until the UK produces RoHS legislation the full extent of their obligation will remain unclear. They are currently working towards having a full paper trail with material declarations. Riochem™ would like to undertake material testing, such as x-ray fluorescence⁴, but there are no direct financial supports available for SMEs to undertake this.

The product was designed to pre-empt the requirement of the WEEE Directive. Riochem™ sought compliance through assisting disassembly, material separation, material identification and product labelling. The business is initially focussed on B2B sales and is therefore likely to face contractual specifications demanding compliance.

12. CONCLUSION

This case study has shown that with the right support SMEs can implement ecodesign. SMEs require different support structures to large organisations. They also require tailored ecodesign methodologies and design management systems. There is a need for more scaleable ecodesign methodologies as opposed to the current broad prescriptive methodologies. This should be reflected in the development of flexible methodologies that are concise, demand-led, aligned with appropriate timescales and cost-effective to implement.

It is difficult for Riochem™ to measure the full value from implementing ecodesign strategies. It may take a number of years to quantify any returns or benefit. Unfortunately, the majority of European WEEE compliance schemes do not provide any mechanism by which producers can make any gains from implementing ecodesign. This is because the grouping of responsibility within the compliance schemes makes gaining distinction and a reduction in compliance costs through best-practice difficult. The issue of subsidisation of bad-practice is more acute for smaller producers, especially when their products reach wider markets.

Finally, Riochem™ has won a number of international awards for the TinyLab™ reflecting the innovative nature of the product and company. Riochem™ has shown that it is possible for a small business to gain competitive advantage through implementing ecodesign. The process undertaken by Riochem™ and Design Wales has helped the company establish ecodesign benchmarks for any future product development.

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⁴ x-ray fluorescence is a non-destructive surface analysis technique for rapid screening tests.