CASE STUDY INTERIM REPORT
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Website: www.flachshaus.de
Title: Insulation materials from flax fibres
Crop: Flax (linum usitatissimum)
Family Group: fibres
Stage: Commercial
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SUMMARY
Flachshaus is a small private company in Giesendorf, in the former East Germany. They manufacture building insulation material in the form of blocks of fleece. This is made from decorticated flax fibres that are passed through a modified textile non-woven line (patented). To the fibres are added potato starch, to act as a natural binder, and borax salts, to act as a fire retardant and prevent attack from fungus and vermin. The finished material form competes directly in the construction industry against mineral wool or polystyrene foamed blocks. The unique selling point is that it is a completely natural, biodegradable material, yet it meets or exceeds all recognised industry standards for performance of materials of this kind. Flax production in Germany is small (less than 500ha) and most of the raw material is now imported from France/Belgium or Eastern Europe. Note that Germany could easily produce 50,000ha of flax and has done so historically. The problem is lack of financial reward to the farmer/processor, not agronomic unsuitability.

The final product is technically comparable to current industry-standard materials but because of the low density/value ratio, transport is a major cost. The real economic and environmental benefits are therefore only truly realisable if a bioregional approach is taken. Their technology is simple and could easily be replicated at other small factories set-up, under licence, wherever flax or hemp or other suitable fibres

The scale of production is small and Flachshaus are only aiming at the niche environmental market. They do not pose any serious threat to the established insulation industry that produces huge volumes at very low margins from mineral and/or hydrocarbon sourced raw materials.

BACKGROUND

Flachshaus was set-up in the mid-1990's with German regional aid to help boost employment and encourage enterprise in the area. Originally they were contracted to take flax from the near-by Holstein-Flachs Company in Schleswig-Holstein, are grown and primary-processed. This approach reduces the costs both of the raw fibre being delivered and the final product being sent to construction suppliers.They have received financial support from FNR for both product and process development.

SUPPLY CHAIN

The main raw material used is flax fibre in the form of fibre bales bought by Flachshaus on the open market. Mostly the flax is 'tow' grade, meaning it is the lower grade tangled fibres rejected by the scutching turbines of the traditional flax processors. In EU most of these processors are situated in Northern France and Belgium, so Flachshaus might seem at a disadvantage in its situation because of transport costs. However a great deal of low-grade flax fibre is also produced in Eastern Europe and Flachshaus is well placed to obtain this material.
Yields vary greatly, but an average of 2.5 tonnes of fibre can be extracted from each hectare grown. They are not tied to any one supplier and this allows them the freedom to always obtain the best spot price. However flax supply and price levels in Europe vary widely from year to year. This is created by several confounding and independent factors.
1. Flax is traditionally produced for the apparel market and that is cyclic. There is a peak demand every five years or so, as linen becomes a fashion fabric, but a lower, variable demand in other years.
2. The harvest of traditionally grown flax is very dependent on the weather of the small region of France/Belgium in which it is mostly grown. Each harvest will produce a highly variable degree of both quantity and quality of top grade (scutched) fibre. This has a marked effect on the amount and quality (and hence price) of the lower tow grades available on the market.
Depending on the state of these two variables at any one time, the market price of any one grade can

vary by up to a factor of three, and the supply of fibre can be very erratic. To 'hedge' against this, many flax-buying companies have long-term contracts to smooth out these fluctuations. However it is difficult for smaller companies like Flachshaus to take on the consequent financial commitments involved, and much has to be bought on the volatile 'spot' market.
In recent years a number of enterprises have emerged throughout Northern Europe to grow and harvest flax fibre using less traditional methods. Their 'decortication' processing produces only one grade of fibre, equivalent to tow, and the production costs are lower. However these have been singled out by EU subsidy policy for a reduced level of subsidy in a plan first implemented in the 2001 season. As a consequence, many of these enterprises have closed, reducing the number of potential suppliers to Flachshaus.

There is an international trade in flax fibres so raw material can always be obtained from as far afield as China if necessary. However it is vital to maintain quality and consistent performance standards in the finished product and this can be compromised if sources and grades of incoming fibre keep changing.
For best results the fibres should be of consistent length, clean (of shive) to a high degree (less than 3%) and well retted so that the fibres are fine and divide easily. The insulation properties are largely determined by the fineness of the fibres. This determines how much air is trapped in the matrix. Strength and colour are not such important issues.
The current price of suitable flax/hemp fibres is approximately Î600/tonne delivered to factory.
The other ingredients, borax salts and potato starches are both simple commodity materials of low cost and reliable supply.
The technology used by Flachshaus is basic textile non-wovens, with subsystems, modified by them to suit their particular needs and arranged together to form a continuous line. Most of the original machinery is second-hand, though this is being updated as investment allows in order to increase production speeds and reduce production (labour) costs.
The fleece blocks are produced in a range of thickness from 40-200 mm to suit different applications, but the block size it is cut to, is always 1.2m x 0.625m. This is an industry standard size. These are stacked and shrink-wrapped to keep their shape and prevent moisture ingress during transport and storage.

MARKET & MARKETING ISSUES
Insulation can be defined as a barrier to the natural flow of heat from an area of high temperature to one of lower temperature. Many different materials have been developed to fulfil this function. Examples are; insulating concrete; exfoliated vermiculite; fine glass-fibre wool; mineral wool; expanded polystyrene boards and spray-on polyurethane foams. The fleece produced and cut to size by Flachshaus is directly comparable, technically, to a number of products already well established in the construction industry. Competitors to Flachshaus therefore fall into two categories:

1. Producers of alternative, but man-made materials such as mineral wool or glass and polystyrene, who tend to have large production facilities and concentrate on bulk-sale markets
2. Other small producers of natural materials competing on the same environmental issue but using a different material and/or technology. Examples are hemp fibre; cork granules; wood-wool slabs and treated recycled newsprint. Currently the only other long-established natural-fibre insulation producer is Thermohanf, also in Germany. This has a contract with the BaFa Company for the supply of raw hemp fibre. They are operating at around 40 tonnes of fibre consumed per month. They use a different technology where 15% of polyester fibre (PE) is introduced into the mat during formation and the fleece is produced by heat-set of the PE in an oven as the last stage. The material therefore is not fully biodegradable, unlike Flachshaus. An Austrian company BIOINNOVA is setting up production with regional aid from the Austrian Government, and in the UK, Hemcore Ltd is shortly to introduce a new hemp-based insulation product, similar to Thermohanf, but to be manufactured in UK.

Buyers of insulation materials are also looking for a number of other features as well as just the insulation value. Amongst these other factors are:
· Physical strength (ease of handling/cutting to size on-site)
· Fire and flame-spread
· Resistance to pests
· Condensation and moisture resistance
· Low thermal conductivity
· Ease of installation and repair/ alteration in future

Currently, prices of the Flachshaus product range from 1.5 - 2 times the price of equivalent degrees of insulation per square metre of wall. When Flachshaus first started it had to sell at over 3 times the conventional price. This premium is probably about right to maintain the product- place in the market as a specialist niche product mainly for use in environmental projects.
Insulation can save the building operator money and reduce environmentally wasteful heat loss to atmosphere, but it often receives little or no publicity. As the cost of energy inevitably increases in coming years - insulation will become much more of a major topic.
As architects and specifiers become more familiar with the use of new, environment-friendly materials such as Flachshaus, sales opportunities will automatically increase. However this is a very slow process. Investment in increasing awareness amongst professionals is needed to ensure that the product is not constrained by ignorance.
The major competitors are multi-national corporations with huge marketing budgets. They are able to easily offer extensive technical advice and free samples services to the industry to familiarise they with an already familiar product.

SWOT ANALYSIS

STRENGTHS
· Based on renewable resources, requiring only low manufacturing energy
· Good protection against fouling, moulding and vermin
· Humidity regulating properties and higher thermal inertia than mineral or synthetic competitors
· Environmentally safe disposal - can be composted at end-of-life
· Skin-friendly during processing and installation - no irritation or allergic reaction.

WEAKNESSES
· Triple the price of final product compared to conventional products
· Price of flax tow can be highly variable year-on-year
· Flax fibre supply can be erratic from year-to-year
· No generic promotional lobby compared to conventional industry

OPPORTUNITIES
· Product innovation to reduce effect of raw material on product price
· Product innovation to reach more profitable market segments
· Process innovation to increase output
· Monetary valuation of benefits to environment (CO2, disposal etc.)

THREATS
· Influence of conventional industry on future building regulations
· Subsidy system for flax, decreasing year-on-year levels of support

FUTURE DEVELOPMENTS
The interest in 'Green Building' i.e. careful study of all the materials and processes used in constructing a building from an environmental point of view, is increasing rapidly. Buildings are generally seen as relatively benign environmentally, and certainly when made from traditional materials this is mostly true. However as demands increase for higher levels of performance e.g. insulation for comfort, more sophisticated materials have been introduced. These can have more serious environmental effects, e.g. formaldehyde resins in pressed boards, used extensively in floors, internal walls and carpentry fittings such as kitchen units.
Because insulation materials are passive and internal in a building they do not attract much public attention or concern. The purchasing decisions therefore are largely left to construction industry professionals who tend to be unfamiliar with agricultural crops, terms, or properties. Demonstration buildings that can then be well publicised are one of the best ways of educating professionals in this sector. The industry has a reputation for being sceptical and 'conservative' of new materials, having had a number of disasters in the past.
The industry is also wary of possible litigation should the material fail to perform in the long-term i.e. biodegrade during the working lifetime as opposed at the end-of-life. Being able to tour and inspect a completed building is very effective proof. However the whole process of creating a demonstration building can take many years to complete.
It is conceivable that new legislation could be introduced to impose an extra tariff on non-

biodegradable materials (landfill tax) or those, which create environmental hazards, or burdens in their production. This would produce a more favourable market place for materials such as Flachshaus, even if it only had the effect of bringing the unique-selling point of Flachshaus to everyone's attention.

CONCLUSIONS

This is a very brave attempt by an individual entrepreneur to create a new product and process and introduce it to notoriously conservative industry. The current scale of the production poses neither a threat to existing industry nor a significant benefit to agriculture in increased acreage of flax.
The principle is readily transferable on a bioregional basis but higher levels of subsidy would be needed for the farmers to grow and supply suitable crop in each area. This is not currently envisaged by EU policy on flax and hemp.