# *Roy Tam*

## *Furniture for LIFE*

Can Craft be a model for industry?

A practice-based presentation of Trannon's eco-design workshop

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This is a practice-based presentation on a craft furniture business which I co-ran from 1992 to 2004. Trannon was set up in the early eighties based on minimising energy usage, and it proved successful enough for us to sell alongside major European designer brands. The presentation describes our principles and practices, and shares some theories that we feel made it work – sustainable sourcing, low energy making, gentle marketing, long product life, and simple design.

## Summary

Our peer cabinet makers liked us as ecologically minded designers, and we sourced timber more locally than most. We were not typical craft furniture makers. David Colwell and I both trained in furniture and product design, and we met at John Makepeace's Hooke Park Eco College. We source trees rather than sawn timber. By using 200mm diameter thinnings, which are under-used by-products of good forest management, we get stronger and straighter grain timber. Because small trees grow fast, they fix more carbon dioxide than mature trees. Ours was sourced within 15 miles, making a big difference in road use. The supply chain for this abundant source is underdeveloped, but recent developments have networked some sawmills and matched supply to demand.

Low energy making includes simple design, and using energy wisely. Steam bending creates useful curves, and involves low capital and high job satisfaction. Kiln-drying energy is no longer needed because steaming seasons green timber. Sustainable design can be a good marketing tool and steam bending naturally communicates the message while quietly adding value. It was this observation that led us to refine our audience experience workshop tour, which we used successfully.

A long product life is more desirable than re-using or recycling, so we focused on making things well, exceeding their purpose, and avoiding fashion. We believed that furniture could have more purposes, such as to help us to interact better with each other socially. And by avoiding fashion, it extends product life because there is no decoration to go out of date.

But the prime reason for competitiveness is in detail design and not concentrating on one-offs. By focusing on small batch production, each maker made thirty chairs in each batch. This way we could increase efficiency by continuously refining the product process overseen by the designer. An example is our C3 Stacking Chair, which after eight years of refinement, averaged just three hours per frame to make – a figure that can compete with industry. As a result of this efficiency, our wholesale prices were competitive enough so that our products could retail in a few London stores at similar prices to major international brands such as B&B Italia and Vitra.

If a small craft workshop could compete internationally, does it indicate that the craft model could be relevant to industry? Further research found examples of successful small group making in industries as large as Volvo Cars in their Kalmar factory. Similarities can be found today in Japanese and Italian industries, so more research would be useful to evaluate these areas.

Could small workshops be the future of manufacturing, or could industry be orgainsed to mimic craft working? Craft can add high value. Design can add competitiveness. Together they can take craft to the mainstream.

A powerpoint presentation (8Mb) accompanies this paper and is available here:
http://www.3ddesign.org.uk/RoyTamMakingFuturesWeb.ppt

## Introduction

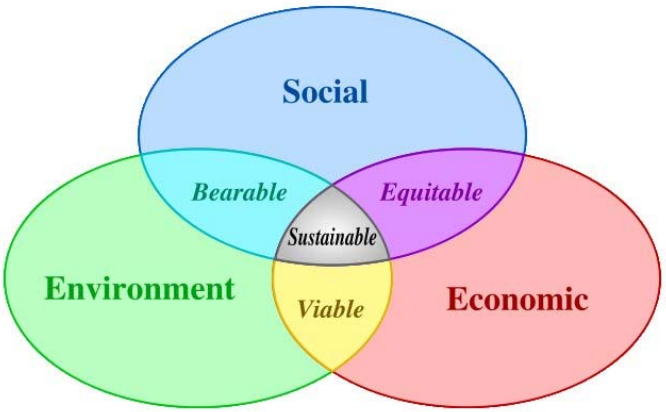
This is a case study about my experience co-directing an ideals-led company called Trannon Furniture between 1992 and 2004. Originally set up by David Colwell in the 1980's as a self-employed business, I joined him to set up Trannon Furniture Limited after we met at John Makepeace's Hooke Park College. We employed between three to seven craftsmen in our workshop in Wiltshire. Today (2009), the core ingredients of Trannon continue as David Colwell Design in mid Wales. I continue with a similar philosophy as Roy Tam Design, with around a quarter of the Trannon product range.

Around sixty percent in value of Trannon's turnover was in the domestic market. Around thirty percent was corporate business, with prestigious clients such as the Scottish Parliament, National Trust, Natural History Museum and the Crafts Council. Ten percent of sales went through galleries and one major shop in central London. Several designs are in international collections such as the V&A and Vitra.

Fig 1. Trannon batch produced range 1978-2004 (Photos Trannon)

I would like to use the opportunity to help like-minded designer makers consider if they wanted to explore similar routes into sustainable design. I hope to do this by describing areas that Trannon differs from mainstream, how some of our philosophies guided design decisions, and some insights into our methods of marketing a craft business.

According to a case study by Stephen Garner (Garner, S. 2006) of the Open University, Trannon illustrates a broad interpretation of sustainability to include social, economic an environmental factors as well as the more focused ecodesign of products today. To illustrate what this means, this diagram below from Wikipedia shows the interrelationship between the three factors.




Source : Wikipedia

Fig 2. Sustainable business (source Wikipedia)

Quoting from the Open University case study, “Trannon provides an opportunity to study a successful furniture business for which the notion of sustainability is central, embracing, for example, the prosperity of the local community, rural employment and forest management.”

I would like to focus on two ideals that were key to the make up of Trannon.

Batch Production:

A batch is typically between five to eighty chairs, and averages around thirty. Batches are repeated an production is assisted by jigs.

Enviromental Impact:

This is a desire to vigorously minimise many aspects of environmental impact by getting to the root cause of the issues, such as embodied energy, materials usage, transport, processing energy, finishing toxicity and long product life.

These two ideals shaped each stage of design, production and sales, and are two of the main factors that made Trannon different to other companies. I will expand on how these two ideals affect the three factors of:

- Material and process (Environmental)
- Design (Social)
- Business (Economics)

## *Material and Process*

Timber is a doubly sustainable raw material. Firstly, it grows into the raw material. Secondly it removes CO2 from the atmosphere and fixes it into its molecular structure, to act as carbon sink. Carbon in wood is not released until it is burnt or rotted away. Wood acts as a carbon sink, reducing atmospheric CO2. At the end of a product's life, timber returns its carbon without polluting landfills or harming wildlife.

### Embodied energy

In comparison with other commonly used materials, timber has very low embodied energy. Embodied energy is the energy used to make a product. In this case it is the energy used to fell, extract, transport, saw and seasoning needed to make trees into usable timber. If timber consumes one unit of energy to turn into raw material, plastics and steel consumes around 90 times, and aluminium 170 times. These points all make timber the favoured material to use.

The method of seasoning timber can make a big difference to its embodied energy. Separate figures for air and kiln-dried timber show that kiln drying uses around four times more energy than air-drying. Green timber requires even less energy than air-drying, and is ideal for steam bending, which I will describe later.

Fig 3. Thinning ash of around forty years (Photo Trannon)

### Thinnings

Thinnings are by-products of forestry that can have an even lower embodied energy. In a managed ash plantation, a forester may plant four to five trees in the area of one mature tree. During the first forty years of planting, all but one tree is felled by thinning. The resultant byproduct is called thinnings. Being grown close together, the young trees compete for light, and so grow faster, straighter and with fewer branches than if they were planted in isolation. Straight and branchless trees mean that more usable can be converted from them. The majority of these thinnings are too small for sale to saw mills, and the smaller diameter trees are sold as firewood. Because thinnings can be sold at half the age of mature trees, it is hoped that this would encourage more woodland planting. In Britain, ash woodlands are most commonly found in the Peak District, Somerset, South Wales, and southwestern Scotland.

It is generally not economical for sawmills to sell thinnings because of the small quantities involved, making this a natural case for sourcing raw materials locally, and directly from woodland owners or their foresters. Trannon's thinnings were sourced from within fifteen to thirty miles of the workshop. Other furniture makers have tried to find their local source of thinnings and we understand that it has been difficult. Recent developments, such as the Sylvanus Trust (www.silvanustrust.org.uk), has produced a

directory of small local timber suppliers in the south west of England to help match supply to demand.

### Why Fast Grown Ash Thinnings

Ash is suited to the UK's climate and as a result grows fast especially when they are young thinnings. Ash thinnings are stronger than mature trees. Ash has excellent ductile strength compared with other commonly used European hardwoods like oak and beech. It has found use in structures where performance is important such as sports racquets, longbows, tool handles and wings of Spitfires. Because of this strength, chairs frames made using ash thinnings can be designed to be flexible, which can be exploited to give more comfort.

Fast grown ash thinnings can fix more CO2 than older trees. This observation is based on the fact that fast grown ash produces a higher volume of timber and at a higher density than those grown slower. Since the main source of wood is carbon captured from atmospheric CO2, it follows that fast grown trees must fix more CO2 than slower grown ones.

### Steam Bending

In the making of chair components, thinnings are planked to one inch in thickness and air-dried to around thirty percent moisture content for steam bending. The ideal growth rate is five growth rings per inch and no more than ten. This green timber is cut into steam bending blanks, just oversized to allow for distortion. Multiple blanks are placed in a steam box and heated for an hour per inch of thickness.

Fig 4. Removing pairs of blanks from steam box after 1 hour (Photo Trannon)

After an hour, components are removed usually in pairs and wedged in a compression strap. The science of steam bending timber relies on the fact that wood fibres are cross-linked by lignin, without which fibres will slide past each other. When lignin reaches around one hundred degrees centigrade, they soften, allowing the fibres to slide. For a piece of timber to bend, the outer side of each bend is stretched, and the inner side compressed. By placing the component in a compression strap, the outer side of the bend is not allowed to stretch, reducing the likelihood of cracking.

Typically, only twenty seconds is allowed between opening the steam box, strapping and bending, otherwise the temperature will have dropped by too much.

Fig 5. Bending C3 main bend within 20 seconds (Photo Trannon)

In comparison to other manufacturing processes, the steam bending cycle rate for similar sized components can be faster than laminating ply veneer and injection moulding plastics. By using multiple sets of compression straps, a whole batch of components can be bent one after another in one steaming. This is important in economic terms for craft businesses to compete against manufacturers. Clever designs that exploit the benefits of steam bending can be one of the great levelers.

Fig 6. C3 main bends still in compression straps (Photo Trannon)

Steam simultaneously seasons the timber and softens it for bending. Whilst in the steam box, moisture is driven out of the green timber by the heat of the steam, in other words it is being seasoned without kiln drying. Industrial kiln drying is an energy intensive process, applying heat and steam over a period of two to three weeks. Steam bending, on the other hand, dries components to around twelve percent moisture content after just one hour of steaming. Final drying, to around eight percent humidity is carried out overnight in a dehumidified chamber, ready for use the next day.

Fig 7. C3 main bends in setting jig ready for final drying (Photo Trannon)

If we looked deeper, green timber has another hidden benefit over commercial kiln drying. In steam bending, the steam only has to heat the component blanks, which are relatively small pieces, compared with drying a whole plank of timber. Since typical timber usage is around sixty percent, this follows that the forty percent timber purchased and discarded as off-cuts would have had kiln-drying energy wasted on them.

On top of this energy saving, we can be added to the savings achieved by the timber's local source, and that extracting thinnings do not need laying new access roads or using big lorries. Steam bending can make the craftsmen's job more satisfying, and can therefore benefit recruiting.

### Finishing

Potmolem Schoolhouse wax, an organic wax was the preferred finish. Water-based lacquers were used between the late eighties to the nineties. Use of oil finishes have the advantage that customers can repair furniture themselves, reducing the carbon cost of transport back to base. Also Potmolem is located less than twenty miles away from our workshop.

## *Design*

The subject of design covers areas including engineered structures, jointing, jigs, user friendliness, aesthetics and long product life. Both ideal of batch production and sustainable design played a large part in influencing design decisions.

Engineering is an area that involved most innovation. Joints are normally the weakest part of a timber structure. In a chair frame, it is the joints that usually break first. No matter how sustainably made a product is, it is equally important to be long lasting. To make a chair last longer, effort was spent to make it less reliant on joint strength. Leverage on joints can be dramatically reduced by triangulated structures and these structures often eliminate twisting forces on its joints. This is widely demonstrated by the use of pin jointing in bridges. Triangulation meant that traditional woodworking joints were sometimes not necessary. The best example to illustrate this is the main frame of the C3 Stacking Chair where there are 'A' frames visible from both the front and the sides. This chair was featured in the Science Museum's Materials Exhibition and is part of the Crafts Council and V&A Museum's permanent collections.

Fig 8. C3 Stacking Chairs (Photo Trannon)

Using triangulation, the frame does not exert twisting forces on the joints, so most of the frame is pin jointed. In fact, when sat on, none of the joints in a C3 are put into tension, only in compression or shear. Therefore it can potentially be used without any glue. It means that, in production, drilling replaces mortising. Much less cramping is needed during assembly. By designing chairs that stack, a batch of thirty C3 frames only

occupies roughly the space of five chairs. The chair seats are only fitted to the frames just before delivery, which meant that deliveries to upholstery subcontractors are kept to a minimum.

Most operations are jigged using fairly low cost materials like chipboard. One of the most innovative jigs is one used in bending the solid backs of the C2 Director's Chair. After steaming, a pair of back blanks are clamped together at their extremities, and a triangular 'cam' is twisted to push them part, resulting in a three-dimensional saddle shape for lumbar support. If the backs were made by laminating ply, they would have needed a complicated three dimensionally shaped former, and complex clamping.

Fig 9. C2 Director's Chairs and pair of back bends showing cam (Photo Trannon)

There were many other efficiency-oriented production details. They include wood turnings that were scribed with thin grooves that mark the start and finish of a mortise, and a mortise and tenon joint that allows for wide tolerances by hiding any gaps. It is important to realise that design details such as these can usually only be made if there is a combination of two factors: a repeatable batched product, and a designer who is also involved in the making. By staying involved with the making process, a designer can discover what needs to be improved and have the authority to act on it.

Good design can lengthen product life. If a design is fit for its purpose, then it gets used for a long time. Similarly if it does not go out of fashion, then it will be kept for longer. Designs that use decoration tends to draw on fashionable trends. By definition, they are more likely to go out of fashion, and have to be discarded before it reaches the end of its product life.

## *Business*

A sustainable business has to make economic sense. Although a green credential was important to our customers, it was not the deciding factor for their purchasing decisions. Few customers buy sustainable designs if they were not good designs at the right price. Whether it was aesthetics, comfort, functions or quality, products needed to be as well designed as the best international competitor.

Much of Trannon's business came from repeat customers, and new business was mainly generated from exhibitions, a website, and a showroom supported by a workshop experience. Over the years, the most successful exhibition for domestic customers was the Chelsea Crafts Fair, now called Select, and for corporate business 100% Design. Others include House & Garden, Country Living, Collect, Mode and Spectrum, now called Prima. Being there was half the work. Past customers had to be vetted and around 200 were sent invitations to visit each exhibition. While at the exhibitions, potential customers were invited to future steam bending workshop open days. The uniqueness of this event made it easy for us to ask for their contact details, which was very important to develop our database.

Economically, had we not been making clever structures that saves us time on making, we would not have been able to sell competitively against major UK and European competitors. As an indication, the C3 Stacking Chair frame averages 3 hours each to make, resulting in a competitive ex-works cost. Three hours per chair frame compares well with the production rate in more automated factories producing a few hundred chairs a day. Because of its comfort, uniqueness and pedigree (V&A collection) we were able to retail C3s at industry normal markups.

Customers in this category are also interested in other qualities in life. They value good ergonomics whether this means that they benefit from a healthy posture or from enjoying longer dinner parties with friends. They will buy a comfortable dining chair and may well choose one that will support them comfortably when they sit sideways to have an after dinner conversation. The C6 is one of those chairs that receives great customer feedback, such as “Our C6s were so comfortable that our friends didn’t want to leave after dinner.”

How did we make the most of our Unique Selling Points (USPs)? Firstly, by showing visitors our steam bending workshop. Steam bending is one of those processes that attracts a captive audience, so why not use it to educate visitors about how we reduce our environmental impact?

We did not have to differentiate ourselves on price from other designer makers because due to batch production, our prices are more competitive. In fact, many designer makers visit our open days. On many occasions, past customers would voluntarily ‘do the selling’ to our potential new customers.

Secondly, until a customer knew about a unique feature, we did not have a USP. Customers may not have considered a certain feature before. If they knew, they might find it desirable, and add it to their requirement. For example, we can exploit that fact that we can make a dining table to any size and shape, while a shop cannot. The correct size and shape of a table is important to create a good socialable dining atmosphere, as well as allowing enough circulating space in the dining area. So to demonstrate that this USP is important to them, we might make a full size cardboard template for them to take home to try out over different meals and bring feedback. Each additional engagement makes our USP even more unique, and these differentiated us further. If our unique shape becomes a USP, then no shop can compete with us on that feature.

I would like to touch on another benefit of batch production because it enabled us to trade in different sectors of the market - domestic, contract and wholesale. If a chair costed £150 to make, a shop may mark it up by 100 percent to retail at £300, which is also our retail price. If we made a batch of thirty chairs, some might fetch £150 from a shop, and some £300 direct. Some might fetch £180 for a corporate order, and some £200 for a gallery order. Batch production can take advantage of this combination of markets. Even when we sold a few items to shops at breakeven price, all costs had been accounted for, so our overheads were diluted.

Finally, one observation about the craft industry is that crafts should not be looked down upon as lifestyle businesses. If a small craft workshop could compete internationally, does it indicate that the craft model could be relevant to industry? Further research found examples of successful small group making in industries as large as Volvo Cars in their Kalmar factory.

According to the Crafts Council, crafts in the UK has a significant turnover of nearly £900m. In Italy and Japan, small workshop similar to our crafts industry makes essential components to the main industries, and it can be argued that the crafts method of working is more efficient than a factory. Should crafts be the model to industry?

Could small workshops be the future of manufacturing, or could industry be orgainsed to mimic craft working? Craft can add high value. Design can add competitiveness. Together they can take craft to the mainstream.

**Conclusion**

This case study of Trannon explores my view of how and why its ideals have driven a successful craft business. The aim of this is to provide an insight for other sustainable crafts makers to consider whether this way of working would benefit their business. We have found it highly desirable to have a least part of the business making in batch production. Batch production is a key driver for innovative techniques that could benefit efficiency, desirability, and create sustainable designs that stands the test of time.

## References

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Milne, G. *Embodied Energy.* A joint initiative of the Australian Government and the design and construction industries (online). Available from: http://www.yourhome.gov.au/technical/pubs/fs52.pdf [Accessed on 15 Aug 2009]

Berggren, C. 1993. *Alternatives to lean production: work organization in the Swedish auto industry*. Cornell University Press

## Appendix A

Links:

Trannon Furniture 1992-2004 archived website
www.trannonfurniture.btinternet.co.uk

Roy Tam Design
www.eco-furniture.co.uk

David Colwell Design
www.davidcolwell.com