Life Cycle Costing of Print on Demand Digital Printing of Books and Packaging Materials

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Abstract

Digital printing appears to be costly relative to other print processes from a unit cost point of view. But there are many other costs in the supply chain for printed products, some of which can be reduced or eliminated by a print-on-demand approach and changing the supply chain structure. Viewing the costs then of the whole supply chain leads to the concept of life cycle costing, which takes into account the administration, distribution, waste and warehousing costs, as well as production costs. Print-on-demand can result in savings in the overall supply chain offsetting the higher production costs in production.

Print-on-demand is most conveniently undertaken using digital print technology. By comparing life cycle costs of conventional methods of production using established and conventional supply chains with digital POD methods of production based around restructured supply chains it is possible to identify circumstances within which POD can work in a viable fashion. For softcover books, for example, in situations where the rate of sale is likely to be less than 1000 copies per annum, then POD digital production is likely to be a preferred option.

Introduction – Supply Chain Concepts

In the production, distribution and retailing of books and packaged goods there is much "hidden" cost in the process related to holding stock in warehouses, and in retail stores, and the possibility that stock will become obsolete or never be sold for some other reason. This then results in quite high waste. In the UK it is estimated that 30% of books are never sold. Also, many books, particularly of an academic nature, only ever sell in small quantities, and even where initial sales are good, most books reach a point in their lives where the rate of sale is so slow as to hardly justify maintaining stocks. All these issues can be addressed by a print on demand approach where production only takes place after an order has been received (1). Digital print technology is well suited to on-demand production, but has a relatively high unit cost which needs to be offset by savings elsewhere in the supply chain to make a viable business. This is best achieved by also changing the supply chain structure. There are four main supply chain structures which are appropriate for on-demand production:

1. The conventional model (using digital print technology)
2. The virtual warehouse model
3. The in-store production model
4. The integrated publishing/production/retailing model

The Conventional Model

The key feature of this model is that it uses digital print in a print company, working in the supply chain as it has always done, but producing books in small quantities or single copies on demand.

The principal advantages of this approach are risk reduction, and reduction in warehousing and stock, but it turns out to be difficult for a print company to work in this way.

The Virtual Warehouse Model

The key feature of this model is the siting of the digital print operation at a distribution warehouse which optimises the order processing process and the subsequent delivery of the book. Warehousing, distribution and production are effectively combined.

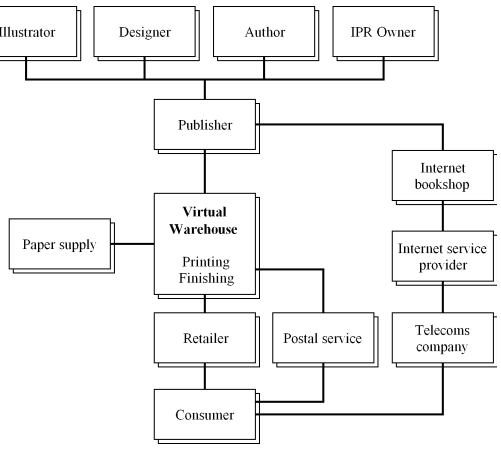

Figure 1. Virtual Warehouse supply chain

The advantage of this approach is that it combines previously separate functions at a key point in the supply chain. From the publisher's viewpoint, it provides some alternatives to conventional production which reduce risk, and capital employed.

The In-Store Production Model

The key feature of this model is in-store production of one-offs produced to order. Retailing and production are combined so eliminating distribution and handling costs. However, production costs are higher, and the viability of this model with current production equipment is questionable.

Integrated Publishing/Production/Retailing Model

The key feature of this model is an Internet based sales approach driving an in-house digital print production facility. Thus there is never any stock, everything is produced on demand. In this case, the opportunity for revenue retention by the publisher is greatly enhanced although there are some associated costs.

Package Printing

Package printing has some similar characteristics to books in that stocks of pre-printed packaging exist and there are warehouses of packed finished goods. Because of product variants, different languages and legislation concerning on-pack information, there is considerable complexity to satisfying all the packaging requirements. Substantial waste exists, and timescales can be long.

By modifying the supply chain, and combining processes so that printing of packaging occurs in-line and concurrently with the filling of that packaging, thereby making an on-demand scenario a reality, substantial advantages and savings can be realised. Where this has been done in a pharmaceutical application(2) savings of up to 30% in overall costs have been obtained.

Life Cycle Cost Models

To examine the difference between supply chains, models have been constructed which examine all the cost elements in the life cycle of a book, sum these, calculate the expected sales revenue of a title in the course of (say) a year, and allocate the difference between these amounts as the publisher's gross margin. In each case examined, a comparison is made with conventional production.

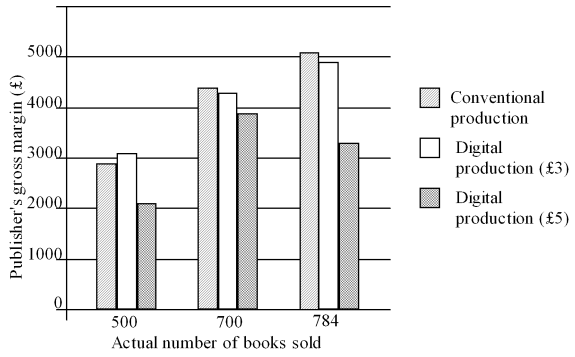

Figure 2. Virtual Warehouse 1-off digital production

Taking the virtual warehouse scenario as an example (digital printed books being produced on-demand in quantities of 1 in response to an order), with the assumption that this digital production takes place at the wholesaler's warehouse, figure 2 compares digital production against conventional production in batches of 1000 copies. It demonstrates clearly that if the digitally produced book can be obtained for £3 (5Euros), then the publisher's margin is very close to that with conventional production (assuming a production cost of £1 (1.5Euros). But inspection of the model also shows that with digital production, the capital at risk is close to zero, whereas with conventional, it stands on average at approximately 750Euros. At lower sale levels, the outcome is even more favourable for POD digital production.

Similar calculations have been carried out for the other models which show that in-store production, if it can be made to work technically, would be more advantageous to the publisher, and that the integrated publishing/production/retailing model is also particularly well suited to low volume, high value, niche publications.

Conclusions

A number of new business models have emerged for on-demand production. These all involve combining two or more previously separate functions in the supply chain.

An analysis of life cycle costs shows that where book sales per annum are less than 1000, digital production provides a publisher with comparable gross margins to conventional production, but with almost none of the risk, and elimination of most of the working capital involved in holding stock in the conventional supply chain.

Applying similar principles in a packaging context also brings substantial overall cost savings.

References

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Biography

John Birkenshaw received his BSc. in Printing Technology from West Herts University, UK in 1970, initially working in an R&D capacity for a large printing group. Since 1974 he has worked for Pira International and for 15 years has been Manager of the Pre-press and Print Group, a consultancy group serving the printing and publishing industry in the UK and elsewhere. His core activities are assisting companies with business strategy development, and undertaking substantial futures studies aimed at understanding the impact of technological development on aspects of the print and publishing industries.