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CAN THE BENEFITS OF GOOD DESIGN BE QUANTIFIED?

by Robin Roy

Why attempt to quantify design and design management?

Many business managers need convincing quantitative evidence of the benefits of employing professional design expertise, improving design management skills and developing a design strategy before they are willing to invest their company's scarce resources of time and money. Yet until recently virtually no quantitative information on the business returns on investing in design and effective design management has been available. Most of the available information has been anecdotal or based on case studies of "winning" companies¹ and successful projects². Virtually the only systematic quantitative information came from studies of success and failure in industrial innovation³ and new product development⁴. Alternatively some information came from economic research, in which design occasionally featured as one of many 'non-price factors' in competition⁵ or as a component

¹See Christopher Lorenz, *The Design Dimension* (Oxford and New York: Basil Blackwell, 1986); James Pilditch, *Winning Ways*, (London: Harper and Row, 1987).

²See Design Management Institute, "Designing for Product Success", Boston: Design Management Institute Press, 1989; Colin Clipson et al., "The Competitive Edge: The Role of Design in American Corporations - Business/Design Cases", Ann Arbor: Architecture and Planning Research Laboratory, University of Michigan, 1984; Design Council, "Design to Win: Case Histories", London: The Design Council, 1990.

³Science Policy Research Unit, "Success and Failure in Industrial Innovation", London: Centre for the Study of Industrial Innovation, 1972.

⁴See Robert G. Cooper, *Winning at New Products* (Reading, MA.: Addison Wesley, 1986).

⁵See, for example, Graham J. Hooley et al., "Strategic Market Environments", *Journal of Marketing Management*, Vol. 4 No. 2, Winter 1988, pp.131-147.

of research and development⁶. It is hardly surprising that design and design management have lost out to other areas of business - marketing, R & D, manufacturing and so on.

The Design Innovation Group (DIG) has for many years been attempting to provide systematic, quantitative information on the advantages and the risks for business of investing resources in improving design and its effective management. The DIG is a British multidisciplinary research group based in the Design department at the Open University and the School of Management at the University of Manchester Institute of Science and Technology.

In this article I will outline the different methodological approaches used in some of the studies undertaken by the DIG and others over the past decade, plus a few results of those studies. I will note the deficiencies of the different approaches before looking forward to what still needs to be done to improve the quantification of design management results.

Good design and business success

The DIG's initial studies were aimed at investigating whether companies that produced well-designed products were commercially more successful than randomly-selected companies competing in the same industries. These studies also set out to isolate the design management practices and other characteristics of the "successful" companies⁷.

For these studies the DIG selected contrasting industry sectors from which to sample companies. The companies ranged in size from small businesses with under 20 employees to multinationals with over 10,000 staff. Initially we looked at plastics products (ranging from toys to engineering components) in which 48 UK-based companies and one world-leading Danish company were studied. The second phase work examined three further sectors - office furniture, domestic heating equipment and electronic office equipment - and involved nine world-leading companies from Denmark, Sweden, Germany,

⁶See for example J. Cox and H. Kriegbaum, *Innovation and Industrial Strength in the UK, West Germany, the United States and Japan* (London: Policy Studies Institute, 1989).

⁷Full details and results of these studies are given in Vivien Walsh, Robin Roy, Margaret Bruce and Stephen Potter, *Winning by Design: Technology, Product Design and International Competitiveness* (Oxford and Cambridge, MA.: Blackwell, 1992).

Japan and Canada as well as 42 British companies. In addition comparative studies were carried out in other industries, including lighting, consumer electronics, motor vehicle manufacture, bicycles and railways. In all over 100 companies were studied, mainly by in-depth structured interviews with managers, designers and technical staff.

Performance indicators

In attempting to quantify the influence of design and successful design management practices on business performance it was first necessary to decide what to measure and then how to relate the variables to each other.

Clearly it was necessary to have some measures of business performance. A survey by Booz, Allen and Hamilton showed that return on investment, profit contribution and sales were the most common financial measures of new product performance⁸. We therefore defined business performance as comprising several key indicators, including return on capital, profit margin, profit growth, turnover growth and export sales. Fortunately such business indicators are fairly readily accessible in most countries, either from official company returns or from commercial databases such as InterCompany Comparisons or the Strategic Planning Institute's PIMS database. However, it is important to recognise that these indicators are only as valid as the accounts submitted by the companies. Also to establish a relationship between business performance and other indicators it is necessary to obtain business indicators for a period of at least 3 to 5 years *after* the design management or other changes are introduced.

Design success is far more difficult to measure than business performance and depends upon who is doing the evaluation. Managers may define design success in terms of a product's commercial impact; engineers may view a successful design in terms of its technical performance; industrial designers in terms of ergonomics and appearance; purchasers in terms of value for money, and so on. A "successful" design therefore may be seen as the plan for a commercially successful product, as one that embodies sound technical, aesthetic, etc. principles, or as a design that successfully meets users' needs. Given the difficulty of measuring design success, we used available indicators of a company's reputation for producing well-designed products,

⁸Booz, Allen and Hamilton "New Products Management for the 1980s", New York: Booz, Allen and Hamilton Inc., 1982.

namely its success in gaining various design awards, plus the views of other companies in the same industry. For our studies we measured:

- The total number of awards and prizes for design won by each company, including Design Council Awards (now British Design Awards) and/or other relevant industry awards and prizes.
- The number of times a company's products were cited on the Design Council's Selection of well-designed British goods. (This scheme, formerly known as the Design Index, was discontinued in 1988 after being in operation for nearly 30 years.)
- The number of times a company was mentioned by its competitors as making the best designed products in their industrial sector.

The advantage of design awards, prizes and citations is that they are fairly easy to count. Their drawback is that their coverage is patchy and the awards, etc. are decided by panels of "experts" whose judgements are inevitably subjective and often based on very limited information. A company's reputation for good design among its competitors is probably a more reliable measure, as it is established over a long period and is often based on a deep knowledge of an industry. We generally found widespread agreement within a sector on which companies were the design leaders.

Good design means good business

The next step was to see if there were any links between business performance and good design. [This required a major effort in data analysis involving a custom-written computer program.] In the plastics products study, we found that eight "design-conscious" companies, which had won various design awards or prizes and/or had one or more products included on the Design Index/Selection, performed significantly better on several business indicators than a randomly selected sample of "representative" companies without such accolades (see Figure 1). The differences in turnover growth, capital growth and return on capital, averaged over 7 years, were statistically significant - meaning that the better business performance of the design-conscious companies was not just a matter of chance.

Figure 1 near here.

In the study of furniture, heating and electronics companies there was a positive statistical association between a company's design performance - measured by the number of citations on Design Selection or the number of

awards and prizes for design - and its subsequent average profit margin, supporting the view that good design adds to value and hence to profits per unit sale. The six British furniture, heating and electronics companies which did best overall in design terms (citations, awards and competitor evaluation) had significantly higher profit margins and return on capital than the remaining British companies randomly sampled in these sectors (see Figure 2). [But, unlike the plastics sample, no statistically significant differences in rates of turnover growth or capital growth between these design leaders and the rest was found.]

Figure 2 near here

Good design is not enough

Although our studies found that companies that were recognised for good design by a variety of awards, citations and the opinions of competing companies were in general more commercially successful than a random sample of companies from the same industries, this was not the whole story. We found fast-growing, profitable companies that made products which were never likely to be recognised for “good design”. A typical example were heating companies that made antique-styled gas and electric fires with an artificial coal or wood burning effect. Such products are very popular in the U.K market, but are never likely to win any design awards. There were also cases of companies which were recognised for their design excellence, but which were not performing well commercially. One example was a manufacturer of photographic darkroom equipment which had consistently won design awards for its products, but which ran into financial difficulties when the market for such equipment declined and the company failed to diversify. Indeed the recession of the late 1980s and early 1990s saw many well-known companies that had built their reputation on making or selling “designer” products losing sales and profits.

In other words producing products that gain recognition for good design can make a positive contribution to business success, but it is not the only route and it cannot *guarantee* success, especially long term. The most commercially successful companies we visited as well as being good at design were also good at other aspects of their business. In particular they had a strategy for growth based on continuous product development; they studied the changing market, and were efficient at manufacturing and selling. In these

companies investment in design was an integral part of corporate strategy in a well-managed business.

One example of a world-leading company from our study, which was both good at design and other aspects of its business, was the famous Danish toy maker, Lego. Lego replaces about a third of its product range each year. This involves extensive market research and substantial in-house design effort. Lego also invests heavily in manufacturing technology and devotes a considerable amount of effort to quality assurance, marketing, packaging and distribution.

Figure 3 about here.

Design management practices

Gaining a competitive edge depends on all-round management capability combined with excellence in at least one area, such as design. We would therefore expect to find links between business performance and the management strategies and practices of companies, including design management. In our studies we analysed this by identifying the differences between commercially successful and less successful companies in organisation and strategy, product planning and marketing, the product design and development process, manufacturing technology, and so on. In addition we specifically compared the design management practices of the overseas companies we visited, which were selected as “benchmarks” for their competitive performance on world markets, with a randomly selected sample of British companies from the same industries.

There is not space here to give detailed results of this analysis⁹. Statistically the most significant difference between the commercially successful companies and the others was the care they took in drawing up a comprehensive design brief at the start of any major product development project. This difference was most marked when we compared the benchmark overseas companies with typical UK businesses in the furniture, heating and electronics sectors. These successful overseas companies generally produced briefs that contained fuller specifications of product requirements than their British rivals. This was because in the overseas companies drawing up the brief was normally a *group* responsibility, rather than that of a single

⁹For full results see *Winning by Design*.

department or individual typical of the British companies. Indeed it was not surprising to find that team working for the whole product development process was more common in the benchmark overseas companies than in the typical British ones and that project teams or interdepartmental development committees were the most common methods of coordinating product development in the fastest growing companies from all countries.

There were other major differences too, though not all were statistically significant. For example, commercially successful companies employed the best quality in-house or consultant designers they could afford; less successful ones often relied on people with other main jobs, or on customers and suppliers, to do design. The benchmark overseas companies recognised the risks involved in innovation and were not afraid to use competitors' products as the starting point for their own design ideas. Indeed most of the benchmark companies in our sample had a dual strategy of innovating occasionally, but most of the time improving on their own and other people's designs.

Other studies have also attempted to relate design management strategies and practices to business indicators. For example, one in-depth study of 20 engineering companies found that product sales performance was positively correlated with a detailed written design specification prepared by managers together with customers or sales staff¹⁰. In another, a survey of 369 U.K manufacturing companies showed that a management strategy that encourages radical innovations in product development, coupled with marketing inputs to ensure that products meet user requirements, is most likely to lead to rapid sales growth and that involvement of top managers, engineers, industrial designers and suppliers throughout product development is associated with effective new product introduction¹¹.

Measurement problems

¹⁰Kulwant Pawar "An investigation of the working relationship between product design and production functions in manufacturing companies", Unpublished Ph.D thesis, University of Aston, Birmingham, Great Britain, 1985.

¹¹Linda M. Service, Susan J. Hart and Michael J. Baker, *Profit by Design* (London: The Design Council, 1989).

Although the kinds of studies outlined above have provided useful information on the likely quantitative outcomes of investment in design and design management, they pose some important problems. I have already noted the drawbacks of available measures of business and design success. Further problems arise when attempts are made to relate these measures to each other and to other variables such as design management practices. First, business performance indicators are normally measured for a whole company, while design awards, etc. are usually given for specific products or ranges. So good business performance may only be partly due to the award-winning products or ranges. Second, as we have seen, business success is the result of all-round company performance. Thus specific design management strategies or practices will be only one of many factors underlying a company's success. Third, the launch of a product or range, or the introduction of particular design management approaches, will take time to show themselves in improved business performance. Finally the relationships between design and business performance are complex and interactive. Successful businesses, for example, are more likely to have the resources to invest in design and its effective management than those in financial difficulties.

The Commercial Impacts of Design

It was these kinds of problems that led the DIG to adopt a different approach for its next major study, entitled the Commercial Impacts of Design (CID).

The main aim of the CID study was to assess the risks and returns of investment in *professional* design at a *product* or *project* level. This involved assessing:

- the inputs of money and of research, design and development expertise in specific projects in manufacturing companies;
- the outcomes of those design projects in terms of financial returns, trade effects and indirect impacts.
- design management practices that had a major influence on the commercial outcomes.

I will not discuss the method used as that was done in a previous article by Stephen Potter¹². Essentially the study involved a face-to-face interview and postal questionnaire survey of 221 small and medium-sized U.K manufacturers which had received a government subsidy to employ a professional design consultant to help with a specific design or product development project.

The projects ranged from the development of industrial lasers and railway equipment to the design of textiles and food packaging. Given the limited amount of subsidy available, the design consultants often played a relatively small role in the overall project and we therefore evaluated the *whole* project including the contributions of in-house engineers and designers.

There is only space here to give examples of the findings of the project - Stephen Potter's article provides a summary and full results are also published¹³. The examples illustrate the role of both quantitative and qualitative measures in this kind of study.

¹²Stephen Potter, "Studying sensitive issues: using a sample survey in design management research", *Design Management Journal*, Vol. 3 No. 4, Fall 1992, pp. 35-39.

¹³Stephen Potter, Robin Roy, Claire H. Capon, Margaret Bruce, Vivien Walsh and Jenny Lewis, *The Benefits and Costs of Investment in Design: Using Professional Design Expertise in Product, Engineering and Graphics Projects* (Design Innovation Group Report 03), Design Innovation Group, The Open University and UMIST, Great Britain, July 1991.

For example, on the input side quantitative data was gathered, for as many projects as possible, on the total research, design, development, tooling and launch marketing costs. Each project was then classified qualitatively according to the main type of design expertise involved - product design (e.g furniture, textiles), engineering design, engineering plus industrial design (e.g electronics plus ergonomics) and graphic design. The project outcomes were also assessed qualitatively and qualitatively; first whether the project was implemented (put into production), then its financial results and finally indirect benefits such as learning design management skills.

Financial returns

The area where quantitative data played the largest part was in the assessment of financial returns. But even here it was necessary to use qualitative information. We were able to obtain detailed quantified financial data on costs, sales and profit margins in 91 cases. For a further 90 projects we had to rely on managers' qualitative judgements of the commercial success of a project. That left 40 projects for which we did not obtain commercial information.

Overall, of the projects for which we had quantitative or qualitative data, 60% were "commercially successful" while 40% made a loss. More graphics projects were commercially successful than product design or combined engineering and industrial design ones, while most pure engineering projects made a loss (see Figure 4). However, once we eliminated the projects which were abandoned before being put into production these differences disappeared. Thus for the *implemented* projects with quantitative or qualitative data, 89% were commercially successful and only 11% loss-making, with no statistically significant differences between the success rates of graphics and the other types of design.

Figure 4 near here

The subsample for which we had full quantitative financial data was analysed in more detail. In particular we calculated the time it would take from the market launch of the new or redesigned product or graphics for profits from sales to recover the total investment (the payback period).

Overall, analysis of this quantitative sample confirmed the earlier results. 69% of all the projects and 94% of those that were implemented paid back their total investment (i.e were profitable) within an average period of 14.5 months (see Figure 5).

Figure 5 near here

These results indicate a very good case for investing in design. Graphics design projects appear to involve little technical uncertainty or financial risk from the outset. And once a project has been implemented, the prospect of a rapid return on the investment becomes very good and the risk of financial loss small for all types of design.

Other factors influencing project outcomes

However, these impressive financial results may not be due solely to the use of professional design. To check this companies were asked to rate the relative influence of design and other factors which might have affected the commercial outcome of the project. In only 15% of projects were factors other than design (e.g marketing, pricing) considered to be a major influence on commercial outcomes. Strictly, of course, we should have eliminated these projects from our study. Nevertheless, while we cannot attribute all the results to effective design and development work alone, it is probable that design played the main part in the success of most of the projects studied. We were probably lucky in that, during the period covered by the survey, external economic conditions were relatively stable. Had we conducted the study during the recent recession it is likely that many more projects would have been affected by external circumstances.

Managing design consultants

[Although the main aim of the research was to quantify the commercial outcomes of design projects, a secondary aim was to identify some of the factors influencing those outcomes. Again there is not space here to discuss the results of that analysis, except to mention one issue. Problems in managing the design consultants was an important factor in those projects that failed to be implemented (34%) or made a loss after implementation

(6%)¹⁴. Analysis of the subsample of companies which had experienced consultant problems and for which we had commercial data, showed that some problems, such as poor contacts between the company and the consultant during the project, tended to reduce the likelihood rather than prevent commercially successful implementation. However, many projects failed due to inadequacies in the design proposals produced by the consultant. Sometimes this was due to the consultant's lack of technical skills, but often it was the result of poor design management by the company. Inadequate briefing of the consultant and disagreement among the company's management about the project's aims were both strongly associated with project failure.

Severe problems of design management were much more likely to occur in the companies with under 100 employees and especially affected the smallest companies with under ten employees, while companies with over 500 employees were virtually free of consultant problems. This suggests that, while small companies are most in need of external help to make up for a lack of in-house specialist skills, such companies require assistance if they are to use external design resources effectively. Such issues are being considered in current research by the Design Innovation Group on the relationships between design consultants and client companies in Britain and Scandinavia¹⁵.]

Future work

Obtaining quantitative evidence on the results of investment in design and design management is not easy. The official evaluation studies of the U.K Government's Support for Design programme failed to obtain quantitative data or relied on estimates of expected commercial outcomes¹⁶. The

¹⁴For details see Robin Roy and Stephen Potter, "Using design consultants for product development in small and medium sized firms", in *The Marketing Initiative* edited by John Saunders (Hemel Hempstead: Simon and Schuster, 1994).

¹⁵See Margaret Bruce and Catherine Docherty "It's all in a relationship: a comparative study of client-design consultant relationships", *Design Studies*, Vol. 14 No. 4, October 1993, pp. 402-422.

¹⁶Rodney Shirley and Dennis Henn, "Support for Design: Final Evaluation Report", Research and Technology Policy Division, Department of Trade and Industry, Great Britain, June

Commercial Impacts of Design study took three years and involved a team of five people. Even so, there is still much scope for further work to improve the value of our results and to extend the approach to new areas.

One question is how representative are the companies and projects we studied? In the CID study we were fairly confident, from examining other surveys, that the companies sampled were typical of small and medium-sized UK manufacturers in their employment of design and development staff and that the projects were typical of design and product development work in such companies. Nevertheless, a comparative study of a randomly-selected “control” sample of companies, most of which would not have received government assistance for design, would be worth doing. A study of large companies and major projects would be even more worthwhile, as the CID study was confined to companies of under 1000 employees and projects involving an average total investment of \$100,000. [The approach could also be extended to the service sector.]

Even with our existing data and sample there is scope for further work. A closer look at the product development process than was possible in the CID study would enable different design management approaches to be related to quantified commercial outcomes. But perhaps more valuable would be a follow-up of the companies concerned to see if the experience of the projects really led to long-term changes in their strategy towards design or ability to manage design projects. Such time-series “cohort studies” are common in other fields and we have a good database on which to base a design management monitoring project.

The CID study was confined to British companies and clearly it would also be valuable to make international comparisons. One such comparison was completed in 1992. A Spanish researcher, Angel Arbonies, used a methodology based on the CID study to survey 29 projects involving government-subsidised industrial design consultants employed by companies in the Basque region¹⁷. Although he was only able to obtain limited financial data, the other findings were broadly similar to ours.

1988; Segal Quince Wicksteed, *Evaluation of the Consultancy Initiatives* (London: Her Majesty's Stationery Office, 1989).

¹⁷Angel Arbonies, “New product design and the role of external design consultants”, Masters thesis, Science Policy Research Unit, University of Sussex, Great Britain, 1993

Further international comparisons are under consideration in Sweden and Canada.

Another area in which the approach developed for the CID study can be applied is to examine the commercial impacts of new directions in design and product development. For example, the Design Innovation Group has recently completed an international study of the development of environmentally-responsible products and the commercial returns on “green design”¹⁸.

Figure 6 near here

More generally, by drawing on the past decade of research, it is possible to devise better ways of quantifying the results of design management. In particular the outcomes of design management changes should be studied at different business levels - strategic, organisational and project - and success indicators matched to the design management level under examination. To give some examples: at the strategic level changes in product strategy could be related to whole company business performance; at the organisational level we might want to relate the appointment of design directors to business performance at company or division level; and at project level changes in the nature of design briefing documents could be related to the commercial performance of the product concerned. It is also important that any studies are sufficiently long-term to allow time for design management changes to affect business performance, whether at strategic, organisational or project levels.

But despite such improvements in quantitative approaches, there is still need for qualitative investigations and case study work. This is because a successful business is dependent on so many interacting factors that we can never be certain that a change in design management, or any other factor, will bring the desired results.

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¹⁸See Stephen Potter with Emma Dewberry, “Ecodesign management: a comparative study of companies in Europe and the USA”, in Proceedings of Fifth International Forum on Design Management Research and Education (Boston: Design Management Institute, 1993)

article. In particular thanks are due to Stephen Potter, who commented on a draft of the article, and to Margaret Bruce, Claire H. Capon and Vivien Walsh.

Suggested reading

The Design Innovation Group publications mentioned in this article may be obtained from Carole Marshall, Design Innovation Group, Faculty of Technology, The Open University, Milton Keynes MK7 6AA, U.K. (Fax: +44 908 654052.)

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