FIRMS AND MARKETS THAT PROFIT FROM INVESTMENT IN DESIGN AND PRODUCT DEVELOPMENT

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ABSTRACT

This paper concerns a study which aimed to identify: (a) how returns from investments in design and product development vary with the types of market in which a firm operates; (b) the long-term benefits of investment in product design and innovation. The study built upon an earlier research project, which involved a survey of design and product development projects in 221 SMEs which had received some government support for design. This paper focuses on the results of a longitudinal, follow-up survey of a sample of 42 firms and projects, 8–9 years after the original study.

- *The firms which had grown in turnover operated in growing markets and had typically developed innovative or niche products, while the declining firms generally operated in static or declining markets in which they had many competitors.*
- *The fast-growing firms employed a statistically significantly higher proportion of RD&D staff; used external expertise for product development more often; and introduced new products more frequently, than the slow-growing or declining firms.*
- *All the growing firms had managers with a positive attitude towards design and innovation and increased their investment in RD&D during the recession, while most managers in the declining firms had a narrow and limited understanding of the contribution of design and reduced their investment.*
- *Since the earlier survey, performance, quality and price remain the key factors in product competition, although there is evidence of price and delivery becoming relatively more important – consistent with trends since the late 1980s in which firms increasingly have to compete on price and service as well as on product quality and design.*
- *SME managers and designers are now aware that multiple factors should be considered when designing a product but, given the differences in the commercial performance of the products, probably not all firms were equally effective in ensuring that these factors were actually taken into account.*

These findings support previous research that business success and investment in design and product development are likely to be mutually reinforcing, while poor financial performance and a failure to invest can lead to a cycle of decline.

BACKGROUND

From 1987-90, the Design Innovation Group undertook a study of design and product development projects in 221 small and medium-sized UK manufacturers which had received government funds to engage a design consultant for a limited period to help with the development of new or improved products, components, packaging, product graphics or technical literature. The firms were sampled to be representative of UK manufacturing industry as a whole and the projects embraced a wide range of products and technologies, from electronic instruments, industrial lasers and railway equipment, to textiles, furniture, domestic ceramics and food packaging. This 'Commercial Impacts of Design' (CID) study provided unique information on the commercial returns and indirect benefits upon investing in professional design expertise at the product level. (Full details may be found in e.g. Potter et al, 1991; Roy and Potter, 1993; Bruce, Potter and Roy, 1995).

Since CID there have been several other attempts to measure the commercial benefits of investing in design and new product development in SMEs. These include a study by Groupe Bernard Juilhet (1995) which examined the extent that a sample of 500 French SMEs invested in industrial design and the costs and benefits of these investments at the firm level. Another study investigated the commercial performance of 38 products which had won a Dutch Good Industrial Design Award (Roerdinkholder, 1995). Both studies indicated that investing in industrial design confers commercial benefits for firms and for products, but it could not be certain that this benefit was the result of investing in professional design expertise or other factors, such as effective marketing. More recent research conducted by Gemser (1997a; 1997b) attempted to overcome the methodological deficiencies of such studies. It compared the business performance of matched samples from two sectors of 20 Dutch SMEs which routinely employed industrial designers with 20 which did not. She showed that furniture and medical/industrial instrument firms which regularly invested in industrial design performed better than those which did not, on a variety of business indicators. More generally a study by Sentance and Clarke (1997) provided empirical evidence of a positive relationship between the level of design expenditure in different manufacturing industry sectors and their rate of output growth over ten years.

None of these studies, however, have addressed the question of whether investment in design and product development is dependent on the market in which the firm operates. Gemser's work provides some clues. In furniture, investment in industrial design was greater in firms making modern designs for up-market customers, whereas in instruments there was no relationship between the price/quality market segment aimed at and design investment.

A new study, entitled 'MArket Demands that Reward Investment in Design' (MADRID) and designed as a follow-up to the CID survey, takes as its starting point the hypothesis that the returns on investing in design and product development depends on the nature of the market in which a company is operating (e.g. the degree to which the market is price or quality-oriented).

Another issue neglected in previous research is the contribution that investing in design and product development makes to competitiveness. Gemser's study again provides some pointers. She showed that the use of industrial designers had a number of positive effects on the design of furniture and medical/industrial instruments, including improved technical performance, more attractive appearance, increased ease of use, and the creation of innovative products. Gemser also showed that the relative importance of these effects differed in the two sectors – in furniture one of the main benefits was on innovativeness, whereas in instruments it was on ease of use. However, the precise roles of design and innovation in improving product competitiveness in different markets has not been studied before and is therefore the second major issue examined in the MADRID project.

The final major area examined in MADRID concerned the long-term benefits of investing in product design and innovation. Access to firms from the earlier CID survey enabled us to explore questions such as: did firms that had successful projects increase their use of professional design expertise and build design and innovation into their company strategy?

THE MADRID STUDY

The MADRID project was divided into two phases:

Phase 1 involved a re analysis of the data on selected projects from the original CID study in order to identify: a) which types of market(s) are most likely to produce the best commercial returns from investments in design and product development by UK firms; b) the contribution of design and innovation to product competitiveness in different markets.

Phase 2 involved a longitudinal, follow-up survey of a sample of 42 CID firms and product development projects, 8–9 years after the original study: a) to provide empirical testing of results obtained in Phase 1; b) to identify long-term benefits of investments in design and product development at both product and company levels; c) to explore relationships between business success, the nature of the market in which the firm operates and its strategic management of design.

The firms and projects for both Phases were sampled to be typical of small and medium-size UK manufacturers.

The full results of Phase 1 have appeared in earlier publications (e.g. Riedel, Roy and Potter, 1996; Roy and Riedel, 1997) and are summarized here in the Box below. This paper therefore focuses on some of the results from Phase 2 of the MADRID project.

MADRID PHASE 1 KEY FINDINGS

- In commercially successful product development projects (measured by payback on the total project investment), design had been used by companies to position or move products 'up-market' into profitable, quality-oriented markets or, in the case of some high-quality niche market products, to reduce costs and thereby increase sales volume.
- In the successful projects more attention had been paid to genuine improvements in product performance, features and build quality than in the loss-making projects, which tended to focus on styling or cost reduction.
- The successful product development projects – and certainly the more technically complex ones – involved a broad, multi-dimensional approach to design with a focus on product performance, features and build quality and, where relevant, technical or design innovation. Loss-making projects tended to involve a narrow, often styling-oriented, approach to design.

THE MADRID SURVEY

METHODOLOGY

We chose firms from the CID database which had conducted product, engineering or engineering/industrial design projects, ranging from furniture and textiles to hand tools, vehicle components and electronic equipment.

Before a visit was arranged a telephone interview was carried out to establish the suitability of the firm and to identify a 'selected product' to be the focus of the face-to-face interview. Where possible we selected the original product surveyed at the time of CID. But if that original product was not in current production, or had become peripheral to the firm's business, we identified a suitable successor product or range. In either case financial information for the 'selected product/range' was requested from the firm before the interview.

A semi-structured questionnaire was designed and piloted in two firms. This questionnaire was then administered in a further 40 interviews, conducted from late 1996 to mid 1997, with senior managers, marketing or technical staff. The interviews each lasted 2–3 hours and provided information:

(a) at *firm* level on ownership, size, turnover, the product range, the firm's markets, employment of research, design and development staff, management attitudes towards design and innovation, etc.

(b) at *product* level focusing on the 'selected product/range' – financial performance; price and quality factors in positioning the product in the market; the role of design and innovation in improving its competitiveness, etc.

An analysis framework was established to allow comparison of the data obtained in the MADRID interviews with some of that from the original CID survey. This data was subjected to both computer-based and manual analysis.

THE MADRID FIRMS AND PRODUCTS

COMPANY SURVIVAL

Very few of the 75 firms initially contacted had gone out of business since the original CID survey of 1988–89. Only four firms had definitely ceased trading and further five firms were untraceable. Thus a maximum of some 20% of the firms have gone out of business, which is a good record for SMEs, especially given the severe UK recession of the early 1990s.

FIRM SIZE

As at CID the majority of firms surveyed were SMEs with below 500 employees (Table 1). Since the CID interviews, the number of people employed by the firms had generally declined, although turnover had generally increased. An exception was that the very small firms at the time of CID had grown in employment.

Table 1 Size of firms

EMPLOYEES	MADRID Firms		At CID Visit	
	Number	Percentage	Number	Percentage
<10	1	2.4%	4	10.5%
10-99	21	51.2%	15	39.5%
100-499	15	36.6%	16	42.1%
500+	4	9.8%	3	7.9%
TOTAL (n)	41*	100%	38†	100%

* 1 not known † 4 not known

WHAT HAPPENED TO THE CID PRODUCTS?

The MADRID interviews sought to discover what happened to the original product/range surveyed at the time of CID (Table 2).

A surprising number (29%) of firms were still making the products developed with assistance under the government Support for Design programme, and which had been first launched between 8 and 14 years ago. Although this apparent lack of new product development can be regarded as negative, in several cases this was not so. For example, the manufacturer of an innovative front-opening bath had built up a substantial niche market around a design which needed little further development. In another case the original product, a range of hospital furniture, had not altered in design, but its manufacture had been automated, thus boosting profits (Figure 1). At the same time new product ranges were introduced.

Table 2 Outcomes of the original supported design projects

OUTCOME	Number	Percentage
Still in production (with only minor modifications)	12	28.6%
Substantially modified/redesigned	6	14.3%
Replaced by a new product or range	15	35.7%
Only produced to special order	4	9.5%
Other developments	5	11.9%
TOTAL (n)	42	100%

14% of firms still made the original product but had substantially modified or redesigned it technically and/or aesthetically. For example, an innovative wire joining device, proved to be an excellent core design which remained in production while variants for new markets were developed (Figure 2).

Over a third had replaced the original product with a new product or range of products in response to market and/or technical change (Figure 3). In many cases this formed part of an expansion of the company's product portfolio.

Some original CID products (e.g. a cardboard case gluing and taping machine) remained available to special order even though successor products had been developed. This occurred where customers still used the original product and wanted the same design when replacements were needed. There were a variety of other developments. In one case the original supported project (a spring-powered torch) had not been implemented at the time of CID, but after many years 'on the shelf' had been developed as a joint venture and was just about to be launched when we revisited the firm.

FIGURES 1 - 3 ABOUT HERE

DESIGN RESOURCES OF THE COMPANIES

In most (nearly 60%) firms, the proportion of staff for whom Research, Design and Development was their main job was less than 5% of all employees. However, there was a strong cluster of firms (27%) where 10% or more of staff are in RD&D (Table 3).

In general there was a similar number of other staff (e.g. managers, marketers), some of whom had RD&D qualifications, who undertook some RD&D as part of another job.

Where a comparison was possible with the CID data, 12 (33%) of companies increased their proportion of RD&D staff, in 6 (16.7%) it was unchanged and in 18 (50%) it had declined.

Table 3 Full-time RD&D staff as a percentage of all employees

% FULL-TIME RD&D STAFF	MADRID Firms		At CID Visit	
	Number	Percentage	Number	Percentage
0%	10	24.4%	6	16.6%
< 2%	6	14.6%	2	5.6%
2 <5%	8	19.5%	12	33.3%
5 < 10%	6	14.6%	9	25.0%
10 <20%	10	24.4%	5	13.8%
> 20%	1	2.4%	2	5.6%
TOTAL (n)	41	100%	36	100%

As well as internal RD&D staff, external design expertise was used by two-thirds of the firms, with a only third doing all their RD&D work in-house. For most companies, external expertise (design consultants, universities, etc.) undertook 20% or less of the design work.

In general, since the CID project, the proportion of design work undertaken externally has dropped from an average of 18% to an average of 11%.

MARKETS, DESIGN MANAGEMENT AND COMPANY SUCCESS

In this section we examine relationships between the performance of the MADRID firms, the nature of the markets in which they operate and their management of design and product development.

FIRM GROWTH AND MARKET TYPE

A number of measures of firm performance were used in MADRID, but the most satisfactory was considered to be turnover growth over the past five years and since the CID survey. Five year turnover growth was used as this information was available from 39 of the 42 companies surveyed and is the performance criterion adopted by Hart and Service (1988), Service, Hart and Baker (1989) and Sentance and Clarke (1997) in their studies of design management and firm success.

Significant break-points were identified that divided the sample into almost equal quartiles, as follows:

- Very fast-growing > 85% turnover growth over past 5 years
- Fast-growing 33 – 77% turnover growth over past 5 years
- Moderately growing 11 – 29% turnover growth over past 5 years
- Static or declining 0% to 59% turnover decline over past 5 years

However, a number of studies show that firm growth has to be considered in the context of the type of market in which the firm is competing. For example, Porter (1980) and Buzzell and Gale (1987) show that the ability of a firm to grow is related, among other things, to whether the market for a firm's products is growing, how many competitors the firm has in that market (competitive intensity), and the maturity of the products involved.

Thus, the types of market in which our sample firms were attempting to survive and grow range from 'very difficult' static or declining markets for mature products fought over by many competitors, to relatively 'easier' growing markets with few competitors.

Our analysis indicated a positive relationship between the firm's turnover growth and growth of the market in which they operated (Table 4) – indeed the relationship was statistically highly significant (Chi-Square $p < 0.003$).

Table 4 Company growth and market type

NATURE OF MARKET	Very fast and Fast growing firms	Moderately growing and Static /Declining firms *
Growing in past 5 years	15 (75%)	6 (28.6%)
Static/declining in past 5 years	5 (25%)	15 (71.4%)
TOTAL	20 (100%)	21 (100%)

* includes 2 Declining firms for which the exact decline is not known

In addition half of the very fast growing firms had developed products for which they had few competitors, either by virtue of offering a novel product or by operating in a specialist market niche. One of these firms had produced a novel product, the wire-joining device mentioned earlier, for which it was finding new markets and applications and as a result had grown in turnover by 1400% in the past 5 years. Another of the fastest growing firms had a range of flame-retardant fabrics for a specialist contract market and had grown by 175% over the past 5 years.

By contrast over 90% of the moderately-growing and declining firms (e.g. a luggage manufacturer) were fighting against several competitors. However, the sub-sample was too small to show a statistically significant relationship between firm growth and competitive intensity.

It is notable that the nature of the market and the type of products made affected whether the firms had grown in turnover alone or in both employment size *and* turnover. One firm that was competing in a very difficult competitive and static market for industrial hand tools had managed to grow fairly fast by reducing its work force by 42% over the past 5 years. This increased productivity, coupled with a range of new and improved designs, enabled it to increase its turnover by 125%.

In general the firms which had increased their productivity most rapidly were spurred to do so by high levels of competition, while most firms operating in less competitive markets managed to grow in both employment and turnover and hence displayed slow-growing or declining productivity.

COMPANY PERFORMANCE AND DESIGN MANAGEMENT

EMPLOYMENT OF RD&D STAFF

Other research (e.g. Cox and Kriegbaum, 1989; Sentance and Clarke, 1997) has indicated that successful manufacturers invest greater resources in Research, Design and Development (RD&D) than less successful ones. We examined whether the human resources employed in RD&D had any effect on company turnover growth.

Table 5 Company growth and employment of RD&D staff

Full-Time RD&D Staff as % All Employees	Very fast and Fast growing firms	Moderately growing and Static /Declining firms
0 < 5%	7 (35%)	12 (66.7%)
5 – 20% +	13 (65%)	6 (33.3%)
TOTAL	20 (100%)	18 (100%)

Table 5 shows that there is a positive link between firm growth and the proportion of full-time RD&D staff employed – indeed the relationship is statistically significant (Chi-Square p = 0.05). Although not shown in the table, the slower growing and declining firms relied more on individuals doing RD&D as part of other tasks. Commonly this was the Managing Director, sometimes with assistance from people like the works manager or shop floor employees.

The change in the number of RD&D staff since the CID interviews supports the relationship of RD&D employment with turnover growth. In the past 8–9 years, two-thirds of the growing firms had maintained or increased their employment of RD&D staff while 60% of static or declining firms had reduced their RD&D numbers.

As well as employing more in-house design staff, the growing firms made greater use of outside expertise (e.g. design consultants) for product development (Table 6) . There is a statistically significant relationship between the use of external design inputs to RD&D and turnover growth (Chi-Square p = 0.006). All the fastest growing firms used external expertise, whereas most of the static and declining firms did not.

Table 6 Company growth and external inputs to RD&D

Use External Inputs to RD&D	Very fast growing firms	Fast-growing firms	Moderately growing firms	Static and declining firms
Yes	10 (100%)	6 (60%)	8 (88.8%)	3 (33.3%)
No	0 (0%)	4 (40%)	1 (11.1%)	6 (66.7%)
TOTAL	10 (100%)	10 (100%)	9 (100%)	9 (100%)

DEVELOPMENT OF NEW AND IMPROVED PRODUCTS

Investment in new product development and improvement is often associated with business success (e.g. Walsh et al. 1992). In our sample we found a statistically significant relationship between the frequency with which the firms introduced new products and their turnover growth (Table 7, Chi-Square p= 0.096).

Table 7 Company growth and new product introduction

Frequency of New Product Introduction	Very fast and Fast growing firms	Moderately growing and Static /Declining firms
Annually or more	11 (68.8%)	4 (36.4%)
Less than annually	5 (31.2%)	7 (63.6%)
TOTAL	16 (100%)	11 (100%)

MANAGEMENT ATTITUDES TOWARDS DESIGN AND INNOVATION

Company success is also often associated with positive management attitudes towards investment and innovation (e.g. Rothwell, 1992). In our sample, we found a highly significant relationship between management attitudes and company growth. All the growing firms had managers with a positive attitude towards the role of product design (and, where appropriate, innovation) and recognized their importance to the success of the firm now and in the future. By contrast the managers in the declining firms predominantly had a limited and narrow understanding of the contribution of design to the success of the firm (Table 8, Chi-Square p = 0.005).

Table 8 Company growth and management attitudes

Management attitudes to design and innovation	Very fast and Fast growing firms	Moderately growing and Static /Declining firms
Very positive or positive	20 (100%)	12 (66.7%)
Limited understanding	0 (0%)	6 (33.3%)
TOTAL	20 (100%)	18 (100%)

There was also an interesting relationship between management attitudes to design and innovation and the firms' markets. Managers in firms operating in growing markets had a more positive attitude to design and innovation than those whose firms were in declining markets. This suggests an interactive relationship – with market growth, positive attitudes and company growth reinforcing each other.

MARKETS, DESIGN AND PRODUCT SUCCESS

The 'selected products' chosen as the focus for the interviews were mentioned earlier and here the focus of analysis shifts to the level of these individual products, their commercial success and market position.

MEASURING PRODUCT SUCCESS

Interviewees were asked to provide data on product sales, exports, profit margin, manufacturing cost, market share and on-going marketing and support costs for the latest 3–4 years. The best data that could be obtained was for sales over 3 years for 20 of the 42 selected products. Quantitative product performance was thus measured in terms of sales growth. As previously for company performance, the sample was divided into equal quartiles, with break points as shown below:

- Very fast-growing — 90% – 306% sales growth over last 3 years
- Fast-growing — 30% – 51% sales growth over last 3 years
- Slow growth/slight decline — 29% sales growth – 11% sales decline over last 3 years
- Rapid decline — 23% – 61% sales decline over last 3 years

As a backup, interviewees were asked to rate their selected product on a 1–5 scale of satisfaction on each of the financial indicators listed above that they considered relevant. Qualitative performance data was obtained for 40 of the selected products and so quartiles (from 'very satisfactory' to 'unsatisfactory') were created using the means of the satisfaction scores provided.

PRODUCT SUCCESS AND THE PRODUCT MARKET

Information was obtained about the nature of the market for the selected product/range, so its commercial performance could be related to key market variables – growth, competitive intensity, and price/quality sensitivity.

MARKET GROWTH AND COMPETITIVENESS

The quantitative data indicated that the products with high rates of sales growth tended to be found in growing markets, while those with slow growing or declining sales were in static or declining markets. This significant result (Chi-Square $p = 0.05$) is not very surprising and mirrors the relationship between turnover and market growth at company level.

MARKET POSITION

Analysis using the qualitative product performance indicators suggested some further relationships with market variables. The latter were measured by the interviewees' positioning of the selected product on a 1-10 scale showing the relative importance of price versus an aggregate quality indicator (comprising performance, styling, reliability, etc.) in selling the product in its market

For example, a relationship between the commercial performance of the product and the price/quality-orientation of its market was indicated. Successful products tended to be competing in quality-oriented markets, while less successful products tended to be competing more often in price-sensitive markets, although the sample (20 products) was too small to demonstrate statistical significance.

Likewise there appeared to be a relationship between the qualitative commercial success of a product and the future market strategy planned for it by the company. Successful products tended to be those for which the company was either satisfied with its market position or planned to increase product quality. In contrast companies often said they planned to reduce the price of the commercially unsatisfactory products in order to improve their competitiveness.

THE COMPETITIVE EDGE

To further explore the nature of competition, interviewees were asked to identify and then rank the factor(s) which they felt gave their selected product a competitive edge over rival products. Table 9 gives some results comparing the responses from MADRID with those from the earlier CID survey.

The results for the competitive edge factors ranked 1 to 3 are remarkably consistent since the CID survey of 8-9 years ago. Functional performance and product quality together with purchase price remain the most important factors in competition. However, there is some evidence of price competition becoming relatively more important, being ranked 1st. by 22% of firms compared to 14% at the time of CID. This is not surprising given the recession and the increased intensity of competition. There is also evidence that product styling has become less important while ease-of-use/safety and prompt delivery have become relatively more important since CID. This could be due to the differences in the samples, but is consistent with general trends in competition in which firms have increasingly to compete on price and service quality as well as on product quality and design.

Table 9 Factors giving the selected product/range a competitive edge

FACTORS	COMPETITIVE EDGE	MADRID Factor Ranked 1, 2 or 3 (81 responses)	CID Factor Ranked 1, 2 or 3 (238 responses)
PRICE	Purchase Price to end user	16.0%	13.4%
	Running Costs to user	2.5%	NA
NON-PRICE	Functional Performance	17.3%)	18.1%
Product	Features	1.2%	NA
	Ease of Use	4.9%	4.6%
	Safety	8.6%	(included above)
	Styling/Image/Visual appeal	7.4%	14.7%
	Quality (Build, materials, reliability)	16.0%	18.1%
	Innovation	2.5%	NA
	Exceeds Regulations/Standards	0%	NA
Range	Extends Product Range	2.5%	NA
	Brand Image	3.7%	NA
Company	Response/Delivery time	11.1%	3.4%
	Marketing/Sales promotion	0%	5.0%
	Customisation	3.7%	6.7%
	Company Image	1.2%	NA
	After-sales support	1.2%	2.9%
	Other (incl. value for money)	NA	13.0%
TOTALS		100%	100%

MADRID = 27 firms (of 42 firms for UK Market); CID = 91 firms (face to face sample)

DESIGN/INNOVATION ROLES

In MADRID Phase 1 the various roles of design and innovation – performance, features, styling, build quality, cost, range, novelty, etc. – in product competition were analysed using the CID survey data (for details see Roy and Riedel, 1997). To provide an empirical follow-up to this analysis, MADRID survey interviewees were asked to rate (on a 5 point scale) the importance of these design and innovation roles for the success of their selected product/range in its market.

The results, obtained for all 42 firms in the survey, showed that the interviewees tended to rate most of the 16 design/innovation roles as 'very important' or 'important' for their selected product. The highest frequencies for were 'improving functional performance' (80.5% rated this role as very important/important); 'improving quality' both actual and perceived (73.2%); 'reducing manufacturing cost' (68.3%); 'providing new or improved features' (65.9%); 'improving product styling' (61.0%) and 'extending the product range' (61.0%). However, some roles were considered less important or unimportant, notably 'reducing product running cost' (78% rated this as less important/unimportant); 'radical product innovation' (70%); 'unifying the product range' (63.4%) and 'improving styling of packaging' (58.5%). Although the frequency of important design/innovation roles is not exactly the same as for the CID products, they are broadly consistent, with product features, styling, range, quality and performance ranking high and running costs, radical innovation and packaging ranking low.

DISCUSSION AND CONCLUSIONS

MARKET POSITION AND COMPETITION

Since the results of the Commercial Impacts of Design study appeared in the early 1990s, there have been several attempts to measure the commercial benefits of investing in design and new product development in SMEs. None of these studies, however, addressed the question of whether investment in design and product development is dependent on the market in which the firm operates.

Re analysing information from the CID study for the MADRID project indicated that, in commercially successful projects, design had been used either to move products into quality-sensitive markets or, in the case of some high-quality niche market products, to reduce costs and thereby increase sales volume. This finding was partially confirmed by the qualitative results of the MADRID follow-up survey. However, since CID there is some evidence of price competition (and prompt delivery) becoming relatively more important. This is consistent with general trends in competition, in which firms have to compete on price as well as on product design and service quality.

DESIGN AND INNOVATION ROLES

Another issue neglected in previous research is the contribution that investing in design and innovation makes to product competitiveness. Re analysis of the CID data showed that the commercially successful product development projects involved a multi-dimensional approach to design, in which more attention had been paid to genuine improvements in product performance, features and build quality than in the loss-making projects, which tended to focus narrowly on styling or costs.

In the follow-up MADRID survey all interviewees tended to rate most of the design/innovation roles as 'important' or 'very important' for their product. This indicates that firms are now aware of the value multi-dimensional approach and understand that design can contribute more than mere styling or cost reduction. Unfortunately this result also meant that these ratings were not sufficiently differentiated to confirm the findings of the CID re analysis regarding design roles and product success.

Overall these responses suggest that managers and designers in SMEs are now *aware* that most factors need to be considered when designing a product but, given the considerable differences in the

commercial performance of the products, it is likely that not all firms were equally *effective* in ensuring that these factors were actually taken into account.

LONG TERM BENEFITS OF DESIGN AND INNOVATION

The final major area examined in MADRID concerns the long-term benefits of investing in product design and innovation. We were surprised to discover that less than 20% of the firms contacted had gone out of business since the original CID survey. This is a good record, given the severe UK recession of the early 1990s, and suggests that SMEs that had sufficient interest in product development to apply for government design support might perform better than more typical firms. Of course, these were all firms which had managed to survive their crucial first five years when an estimated 60% of SMEs fail (DTI, 1996). Nevertheless, several firms, especially in the engineering and building products sectors, had contracted significantly in the recession and many had experienced severe financial problems and one or more changes of ownership.

Other findings of the MADRID survey indicated statistically significant relationships between business success and various measures of long-term investment in design and innovation. Thus, the firms which had grown rapidly in turnover over the past 5 years employed a higher proportion of RD&D staff, had increased their RD&D staff since CID, more often used external expertise for product development, and introduced new products more frequently, than the slow-growing or declining firms. Fast-growing firms also increased their investment in RD&D during the recession, while slow-growing and declining firms reduced or made no change in their investment.

There was also a highly significant relationship between management attitudes and company growth. All the growing firms had managers with a positive attitude towards investment in product design (and, where appropriate, technical innovation). By contrast the declining firms predominantly had a limited and narrow understanding of design and innovation and their relevance to the firm.

These findings are in broad agreement with other research in this field. For example, Sentance and Clarke (1997) provide empirical evidence of a positive relationship between the level of design expenditure in different manufacturing industry sectors and their rate of output growth over ten years. Hart and Service (1988) and Service, Hart and Baker (1989) have shown that successful firms, measured in terms of sales turnover growth, had a positive top management attitude towards research, design and development and were committed to the development of innovative products and improved designs.

The MADRID survey provides some encouraging evidence that a number of UK SMEs have moved beyond thinking in terms of financial returns on one-off design and product development projects and have made design ‘an integral part of corporate strategy’. This was one of the aims of the original Support for Design programme which its evaluators (Shirley and Henn, 1988) suggested had not been achieved by the end of the programme.

DESIGN INVESTMENT AND BUSINESS SUCCESS

The MADRID project confirms once again that the relationship between investment in design and business performance is complex and interactive. As Gemser (1997a) notes, ‘successful firms are more likely to have the resources to invest in design than those in financial difficulties’. In other words business success and investments in design and product development are likely to be mutually reinforcing, while poor financial performance and a failure to invest can lead to a cycle of decline.

Finally the analysis supports the conclusions of earlier work (e.g. Walsh et. al, 1992) that investing in design and product development is likely to be a necessary, but not sufficient, condition for good business performance. This research has indicated how important the market context can be in influencing growth rates, with the fastest growing firms using design to create products for markets that offer opportunities for growth. It has also indicated that different product and market strategies may be required to enable firms to generate new employment as well as grow in sales and profits. Firms that grow in both size and turnover seem to be those that operate in, or can move into, a growing market, preferably with products tailored to a market niche or with innovative products that create or meet a new market demand.

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FIGURE CAPTIONS

(Scanned pictures + captions in separate file]

Figure 1 The Crendon range of wooden hospital furniture, originally developed with assistance from Support for Design, has remained in production since its launch in 1987, but the manufacture of its components has been automated.

Figure 2 The Gripple patented wire joining device, the original design of which was created with assistance from Support for Design, has been significantly improved since its introduction in 1989. The design has been developed into a range of sizes for different applications, for example vine supports. It has also formed the basis of new products for new applications such as a wire rope joiner.

Figure 3 The Alpha 5+ hi-fi amplifier, launched in 1995, is one of a series of new and improved designs that have evolved from the original Arcam Alpha of 1984 developed with assistance under Support for Design. The latest model is the Alpha 7.