Managing the Marketing-Design-Manufacturing Interface: An Empirical Investigation of the Underlying Problems and Solutions

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INTRODUCTION

All firms face the common challenge of creating distinctive capabilities and improving their economic performance. The challenge is particularly acute when you consider how the internal network of intra-organisational relationships impinges on how firms manage their relationships with organisations outside the firm. Indeed, organisations have become increasingly concerned about stimulating and facilitating communication between the various internal functional areas and the external network of customers and suppliers. This concern is motivated because of the significant impact these interfaces have on an organisation's business strategy.

The business and financial success of most organisations depends on their ability to identify the needs of customers and to create products that fulfil these needs with regard to both cost and quality quickly. Achieving these goals is not solely a marketing, design or manufacturing function; instead, it is a cross-functional, boundary spanning process that permeates the interfaces between these functions (see Figure 4.1).

The marketing function mediates the interactions between the firm and its customers. Typically, marketing personnel identify product opportunities by examining customer needs, defining market segments for targeting and

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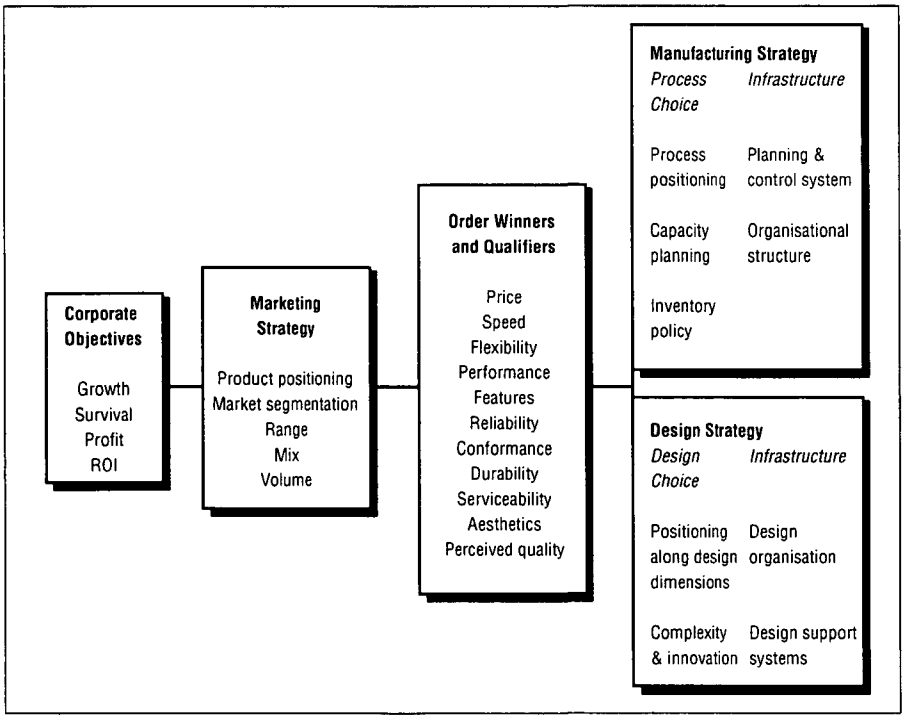
positioning. In addition, marketing is responsible for product launches, promotion and brand development, pricing and channel distribution negotiations, and after sales service.

The design and engineering function focuses on defining the physical form of the product to meet customer requirements best. It is responsible for both engineering design (the development of a product from its technical conception through detail design, and the design of the related manufacturing process and tooling) and industrial design (the aesthetics, styling and user-interface dimension).

The manufacturing function is responsible for designing and operating the production system in order to manufacture the firm's product lines. This involves management choices with regard to production technology, process management, quality, logistics and capacity planning.

The management of these relationships can have a clear impact on business strategy. Manufacturing strategy and design strategy produce the order winners and qualifiers and through its marketing strategy enables an organisation to meet its corporate objectives of growth, survival, profits or return on investment (Figure 4.1).

Figure 4.1: Business Strategy and the Marketing-Manufacturing Interface



Source: Fitzsimons et al. (1991)

The Marketing-Design-Manufacturing Interface

The literature on the relationship between marketing, design and engineering and manufacturing is considerable (Biemans, 1995; Davies-Cooper and Jones, 1995; Gupta, Raj and Wilemon, 1987; Hanson, Voss, Blackmon and Claxton, 1996; Hise, O'Neal, Parasuraman and McNeal, 1990; Moenaert, Souder, De Meyer, 1994; Pegels, 1991). Many of the problems in the relationship between marketing and design stem from the different backgrounds of marketers and designers which foster a lack of interest in each other's work and thinking in stereotypes (Biemans, 1995). A summary of some of these stereotypical perceptions is outlined in Table 4.1. Any analysis of how these interfaces are managed needs to address the role of design and engineering within the organisation (Davies-Cooper and Jones, 1995). This role may be either negligible or substantial. In the former case, the product design and specification will typically be provided by the customer (as in basic sub-contract manufacture), whilst in the latter case the design will typically be developed in-house (companies who design, manufacture and market their own products). Alternatively, some companies carry out both sub-contract and own-product functions. How to manage the above interfaces will be to some extent dependent on the strategic role of design and engineering within the organisation.

The differences in cultures and perceptions can impact negatively on the success of product development. Indeed empirical research suggests that collaborative efforts between marketing and R&D during the actual designing of new products appear to be a key factor in explaining the success levels of new products (Hise et al., 1990). Davies-Cooper and Jones (1995) identified the following problems at the marketing-design and engineering interface. Firstly, marketing executives did not fully understanding the design process. Secondly, there was a lack of clear information supplied to the design team from marketing executives. Thirdly, there was little evidence of mutual respect between the functions and finally, there was a lack of market research and no co-ordination with sales.

Table 4.1: Marketing and Design and Engineering – How they view each other

Marketing People about Technical People	Technical People about Marketing People
Have no sense of time	Want everything now
Don't care about costs	Are aggressive and too demanding
Have no idea of the real world	Are unrealistic
Hide in the laboratory	Make promises they cannot keep
Cannot communicate clearly	Are involved only in advertising and PR
Should be kept away from customers	Are focusing on customers who do not know what they want
Require customers to adapt to themselves	
Lack a service and customer orientation	Make bad predictions

Inadequate attention to competitive issues	Cannot make up their minds
Are always looking for standardisation	Change the design specification frequently
Are inflexible	Are too impatient
Are very conservative	Are more interested in playing golf
Have a narrow view of the world	Are always in a hurry
Always underestimate costs	Do not trust technical people
Have no sense of humour	Set unrealistic goals for profit margins
Are off in another world	Do not understand technology
Are passive	Are not interested in the scientists' or engineers' problems
Do not understand customers	Are too quick in introducing a new product
Cannot stick to schedules	Want to ship products before they are ready
Are only interested in technology	
Are slow	
Never finish developing a product	

Source: Biemans (1995)

With respect to the marketing and manufacturing interface there is a lack of clear and explicit policies that enable managers to manage the problem areas constructively. There is no set of agreed rules within which marketing and manufacturing can operate (Song, Montoya-Weiss and Schmidt, 1997). Each group develop their own functional strategies that relate to the total corporate strategy and neglect to pay particular attention to the needs of other internal functions. There are no measurements of performance against an agreed set of criteria which focus specifically on interfunctional problems.

The rift between the two groups is further escalated because both parties are evaluated and rewarded on the basis of different criteria. Shapiro diagnosed the situation as follows:

> ... the marketing people are judged on the basis of profitable growth of the company in terms of sales, market share, and new markets entered. Unfortunately, the marketers are sometimes more sales-oriented than profit-oriented. On the other hand, the manufacturing people are often evaluated on running a smooth operation at minimum cost. Similarly unfortunately, they are sometimes more cost-oriented than profit-oriented. (1987: 108)

In terms of the co-operation between design and manufacturing function, Davies-Cooper and Jones (1995) in the same study identified the following problems at the design and engineering-manufacturing interface. On one hand, design and engineering did not understand the manufacturing implications of their decisions. On the other hand, manufacturing was seen as constraining design and engineering. The main focus of the manufacturing dissatisfaction centred on not being involved early enough in the design project. They also

criticised the design function for not using the same components for prototypes as intended for production.

Other empirical studies have highlighted the benefits of close interaction between design and engineering and manufacturing (Francis and Winstanley, 1988). They highlight the critical role of frequent consultation in order to ensure that the final product design is within the boundaries of the manufacturing capabilities of the organisation. Close co-operation assists design engineers to design products for ease of manufacture, low cost and high quality. Furthermore, design engineers can provide useful inputs on manufacturing decisions on tooling and on sourcing and supply options. Design teams thus need to have a comprehensive understanding of current and planned process technologies (Francis and Winstanley, 1988). This interface is further complicated by the rapid rate of technological change and shorter product life cycles.

In many new product development projects a large portion of the manufacturing costs are committed early on in the design process. The 80/20 rule first reported by Downey (1969) in the British Aerospace industry found that approximately 80 per cent of manufacturing costs are committed during the first 20 per cent of the design process. Similarly, the use of tools and techniques such as value analysis, quality function deployment and Taguchi methods can be used extensively early on in the design process in order to design quality into the product. Best practice in design management can thus have a direct impact on order-winning criteria such as price, quality and time-to-market.

It is clear these interfaces need to be co-ordinated and managed effectively. Indeed, organisations have become increasingly concerned about stimulating and facilitating communication between the various functional areas. This trend is particularly evident in the area of new product development because of its cross-functional nature. Simultaneous engineering, quality function deployment and cross-functional project teams are among the most widely used practices in this area. Developing new products can have a significant impact on the relationships between these functional areas as decisions taken in one area can cause adverse reactions elsewhere. This paper focuses on how this challenge might be tackled by articulating the problem areas that need to be addressed in co-ordinating and managing these interfaces. Principles of best practices from a range of companies credited with achieving best practices in the area are outlined as potential means to deal with these problem areas.

Methodology

The purpose of this research was to examine the problem areas that need to be addressed in co-ordinating and managing the internal interfaces within companies and to identify principles of best practice to deal with these problem areas. The sample frame chosen consisted of ten companies who had won the Supplier of the Year Award. These companies were chosen because they had been officially recognised for their excellence in meeting their customers' requirements. It was envisaged that their achievements in managing

their external relationships would enable them to respond to the internal interface management issues. As a result, their modes of operation, values and insights were particularly enlightening. Given the fact that a detailed probing of each company's attitudes, values and activities was required for this research, in-depth interviews were deemed the most appropriate research instrument to employ. Furthermore, to facilitate accurate analysis of the data collected, without losing any of the complexity or content of these interviews, the NUD.IST software package for qualitative analysis was utilised.

The following section provides a brief description of the companies who agreed to take part in the research. In order to maintain the confidentiality, which these firms requested, the names of individuals and companies are not mentioned.

Company A

Company A is a well-established metal pressing company, with a reputation for efficient problem solving and quality control. Set up in 1980, it is one of Ireland's most modern press shops with its own design and tool-room facility. It has a dynamic, young and highly skilled workforce of 120 employees, who have a variety of modern production facilities at their disposal. This company is uniquely capable of manufacturing components from the tool design stage right through to the finished product. A full range of sub-assembly and finishing services are also provided, including powder coating and pad printing. Quality approvals and systems include Ship-to-Stock, Just-in-Time (JIT) status, ISO 9000, Statistical Process Control (SPC) and Materials Requirement Planning (MRP). The company also has a continuous investment programme to take full advantage of the latest developments in technology.

Company B

Established in 1964, this company is one of the largest and most modern printing plants in Ireland, employing a team of 115 young professionals. Its comprehensive state of the art equipment and facilities include design, typesetting, finished art studio, plate making, printing and fully automated finishing. In effect, the company is capable of providing the complete print solution, from initial concept to final delivery. In 1987 they became the first print company in Ireland to be awarded the Quality Mark of the Irish Association. The following year, they won the Supplier of the Year Award, while in 1990 they achieved ISO 9000 certification. Several of their vendors have also granted them Ship-to-Stock vendor approval. This company has achieved market leadership largely by developing a unique sensitivity to the requirements of healthcare customers in highly specialised areas such as labelling, inserts, instruction leaflets and booklets.

Company C

Set up by four brothers in 1974, this company quickly built up a reputation as a high quality, reliable supplier. Concentrating on the Irish market initially, they

gradually expanded their customer base to include countries right across Europe, from England to Sweden, Norway, Finland and Germany (where they have been particularly successful). Operating from two modern factories in the Carlow region, they employ a workforce of 150 highly skilled personnel and have an impressive turnover in excess of €8 million per annum. Over 80 per cent of their outputs are exported, while major customers include Volvo, Michigan Euclid, Clark Equipment, Linde, Moffett Industries, Tenco and Ellickson Engineering. This company specialises in manufacturing hydraulic cylinders, ranging from 25mm to 200mm in diameter and up to 7m in length. Most of their products are custom made to very exact standards. Having operated systems such as JIT and Ship-to-Stock long before they became recognised supplier requirements, the company achieved the ISO 9002 award in 1993 and is currently in the process of setting up a World Class Manufacturing (WCM) system.

Company D

Based in the Galway region, this company first began operations in 1977 and currently employs 90 highly motivated and skilled workers. Its activities include sheet metal cutting and forming, tooling, machining, fabrication of mainframes for the computer industry, automated sub-assembly for the automotive industry, machined components for industrial and home appliances, and enclosures to IPS65. The company has the facilities to engage in prototype development, jig and fixture designing, tool pressing, spray-painting, stamping and silk screening, and powder coating polishing. The company's main customers operate in a diverse range of industries, including the computer, automotive, textile, medical, electronic and domestic appliance industries. It is located both in the United States and throughout Europe. Quality standards achieved by this supplier include ISO 300, ISO 9002 and Ship-to-Stock.

Company E

Company E is a relatively young company, having only commenced trading in Cork in 1982. It operates in a niche market, manufacturing PTFE-lined pipes and PTFE-lined systems for customers involved in the chemical-pharmaceutical industry. Basically, the company welds pipes together and then lines them with steel, so that they are chemically resistant for the transfer of acids. By introducing a moulding facility, it was also able to mould raw materials polymer into the fittings, giving them greater flexibility in terms of producing specials for their customers. The company's products are of an exceptionally high quality, meeting Federal Drug Administration Approval and earning it Quality Vendor Awards and the ISO 9002 award in 1994.

Company F

This company designs and manufactures PVC, uPVC and co-extruded plastic profiles for truck trailers, fridges, showers, windows, electrical trunking, seal

gaskets and other products. Established in Dublin in 1984, it now employs 24 people and has annual sales of over €1.9 million. It operates JIT and Ship-to-Stock systems for many of its main customers. Two years ago, the company embarked on a €750,000 expansion programme, which is set to increase its workforce by 50 per cent in the near future. Initially, it concentrated on the Irish and British markets, but in 1995 the company began to consider more distant markets and has since won substantial orders from Germany, Scandinavia and the Middle East, worth more than €250,000.

Company G

Established in 1977, this company produces a comprehensive range of high quality printed and structured components, using a variety of materials from polycarbonate film to aluminium sheets. Its product range includes nameplates and decals, instrumentation and control panels, membrane touch switches, RFI and EMI shielding, structured plastic insulation components and precision printed and fabricated overlays. It has a workforce of 112 highly skilled and motivated employees, serving an impressive list of multinationals, including Thermo King, Apple, Oki (Scotland), Mitsubishi, Compaq, Motorola and Dell. In 1986, this firm became one of the first Irish indigenous manufacturing firms to achieve ISO 9000 accreditation. It now holds ISO 9002 status, Ship-to-Stock vendor status with many key customers and the "Q" mark of the Irish Quality Association. In addition, 80 per cent of its products have Underwriter Laboratories and Canadian Standards Authority recognition.

Company H

Since it was first set up in 1981, this company has maintained a continuous record of growth and achievement. With an enthusiastic and skilled workforce of 45 people, it specialises in the production of high quality precision-turned components up to 60mm in diameter, in materials ranging from mild steels to nylon. The company is capable of carrying out a wide range of activities with these components, including drilling, form cutting, milling and both internal and external threading. It can also engage in heat treatment, surface grinding and other finishes. Principal customers include Thermo King, Apple, Ericsson, ABB Rolex, Krups and Hewlett Packard amongst others. In terms of quality approvals and systems, it has achieved ISO 9002 and the Irish "Q" Mark, while it is currently operating Total Quality Management, Kanban, Zero Defects and Statistical Process Control (SPC) systems.

Company I

Based in Galway, this company was established in 1980 and has since expanded to include a total of 68 employees. Concentrating its efforts on meeting the needs of multinational Original Equipment Manufacturers (OEMs), it produces specialist fasteners and components for use in the mechanical and electronic equipment manufacturing sectors. With a turnover of between €3 million and €5 million per annum, some of its major customers include IBM,

Philips UK, Danfoss A/S and Thermo King Europe. In addition to the Supplier of the Year Award, the company has also received the IQA award and ISO 9002 status. With key customers, it operates SPC, JIT and Ship-to-Stock systems – in some cases, the company has even attained Ship-to-Line status.

Company J

One of Ireland's longest established engineering sub-contracting companies, Company J was set up in 1973 with a working capital of a mere €400. It now has a skilled workforce operating at two modern hi-tech factories in Waterford, producing annual sales of up to €3.5 million. This company provides high quality machined components, assemblies and moulds for customers in a wide range of sectors, including process control equipment, automobile components, food processing, computers and medical equipment. Recently, the company has decided to concentrate on the medicare sector in particular. Principal customers include Allied Signal, Amdal, Bausch and Lomb, Milton Bradley and Summit Technology. Already accredited with ISO 9002, Ship-to-Stock, Ship-to-Line and (in one instance) World Class Supplier Status, the company aims to implement a World Class Manufacturing (WCM) system by the end of 1997.

Findings

The purpose of this research was to examine the problem areas that need to be addressed in co-ordinating and managing the interfaces. The sample frame chosen consisted of companies who had won the Supplier of the Year Award since its introduction in 1984. We felt this sampling frame was an extremely appropriate choice, as these companies had been officially recognised for their excellence in meeting their customers' requirements. As a result, their modes of operation, values and insights were particularly enlightening.

On the whole, the findings strongly supported the literature. The companies examined confirmed the differences in perfection across a number of areas. Our research points to key information flows between internal functions that lead to problem areas that need to be addressed in co-ordinating and managing these business process interfaces.

The main problem areas related to marketing and design and engineering interface concern the identification of order-winning criteria, sales order processing, specifying customer requirements, handling customer enquiries, communicating customer-led modifications to designs, negotiations on pricing and delivery dates. There was strong evidence of what Biemans (1995) defines as "thinking in stereotypes". Respondents believe that a possible explanation lies in how each group's performance is measured. These metrics are not mutually agreed and often run counter to one another. In addition, respondents felt they are reinforced by the education and training background of each group where there is little effort to foster an understanding in each other's work and bridge the differences in cultures.

With respect to the marketing-manufacturing interface, our research

highlights the following interface issues that caused problems: forecasting, production scheduling, delivery capability, quality assurance, cost control, new product development and after-sales service. Similar sentiments as above were expressed between these groups. Both believe that their strategies reflect the total corporate strategy but they fail to accept in following such strategies that they neglect to pay particular attention to the needs of other internal function. Again there is the problem of no common ground on performance metrics.

From the design and engineering-manufacturing perspective the key issues causing concern are: engineering change notices, production routings, tooling requirements, CNC programs, purchase orders and inventory availability. Lack of consultation and not being involved early enough in the design project is the main focus of criticism from manufacturing. While the technical nature of their work provides some common ground, design and engineering felt constrained by the manufacturing people who were mainly concerned with running smooth manufacturing operation at minimum cost.

Finally, it is evident from the research the extent of the problem areas that needed to be addressed in co-ordinating and managing the interface within companies. While the companies acknowledged the extent of the challenge, they also indicated the principles of best practice they adopted to address these problems.

Management Implications and Conclusions

The purpose of this research was to examine the problem areas that need to be addressed in co-ordinating and managing the interfaces within companies and to identify principles of best practices to deal with these problem areas. This section addresses the principles of best practices adopted by the companies as potential means to deal with these interface problem areas. If companies are to manage this interface more effectively and improve interfunctional communication, the following integration mechanisms identified by our research study and other research (Moenaert et al. 1994) provide considerable scope for relationship enhancement in achieving best practice.

Firstly, top management should foster and nurture a positive degree of interest, trust, awareness and support between functional teams. This should assist in addressing the different orientation and experience of the people involved. Managers perceived themselves as culturally different and only seem to be at ease in their own functional areas. Essentially the kind of strategic thinking and leadership that needs to happen is for marketing to focus on external customers with a clear understanding of manufacturing capability.

Secondly, cross-functional groups organised as venture teams, new product project teams, temporary task forces under the direction of a strong project manager are among the most frequently used methods of introducing the above mechanisms (Gupta et al., 1987). Furthermore, the composition of such cross-functional groups should be structured to address other boundary spanning activities.

Thirdly, rules and procedures should be formalised within project teams. This should increase the amount of communication flows between functional areas and ensure the early involvement of both functions in the product development process. These rules and procedures should also provide mechanisms for conflict resolution and can serve as a platform for further informal communication. Clear and explicit policies enable managers to manage problem areas constructively. While each group can develop their own functional strategies that relate to the total corporate strategy, they must do so by paying particular attention to the needs of other internal functions.

Fourthly, decentralisation of decision-making and power down through the organisation should be implemented. Typically this will have a positive impact on interfunctional communication. Moreover, role flexibility or out-of-role behaviour (e.g. marketing personnel running lab tests) should be encouraged in order to enhance interfunctional communication. In addition, informal interfunctional contacts should be organised to generate mutual respect by sharing experiences and concerns.

Fifthly, performance metrics should mutually be agreed and established. Measuring performance against an agreed set of criteria, which focuses specifically on interfunctional problems, is essential for the effective management of these relationships.

Finally, some organisations have created mixed career paths to deepen and foster understanding between functional areas. Managers cross over functional lines during their development thus ensuring they will better understand the activities, concerns and values of their colleagues in other functional areas.

In conclusion, it is important to acknowledge that there are financial implications resulting from these measures. The interface between finance and the other functional areas has received less coverage in the literature. This is probably because of the less frequent level of interaction at this interface. Nonetheless, the central role that financial analysis plays in any organisation has a major impact on performance. Issues such as project management, costing and pricing, profit margin analysis and return on investment, net present value analysis, funding requests and performance metrics should be addressed.

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