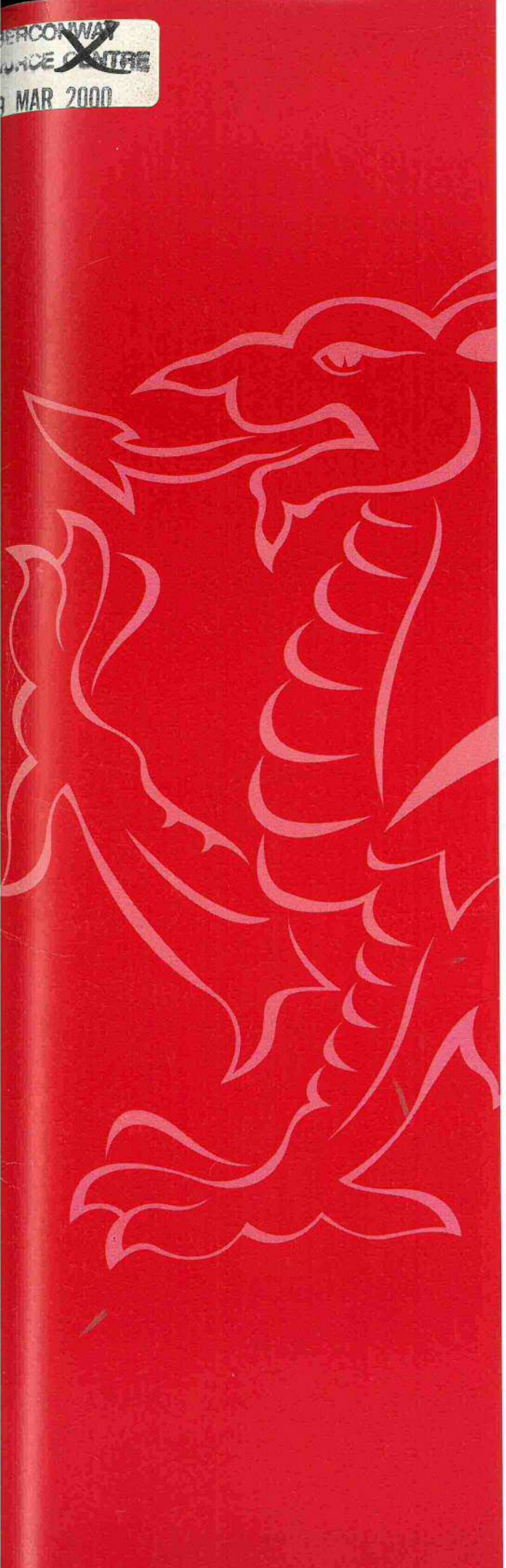

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The Welsh Automotive Component Industry and New Product Development

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1. Introduction

Over the past two decades Wales has been relatively successful in attracting inward investment, and in developing industrial clusters in automotive components and electronics. However the Welsh economy, in general, is still relatively weak in several areas thought to be important to long term regional competitiveness, such as education, entrepreneurship, and notably, research and development (R&D) (Brooksbank and Pickernell, 1998).

This paper examines R&D and more specifically New Product Development (NPD) in the Welsh first tier automotive component industry (i.e. those component firms supplying directly to the vehicle assemblers). In this industry NPD is becoming increasingly important as a means of achieving competitive differentiation. Vehicle manufacturers are focusing on their core competencies, transferring significant responsibility for component design and development to their first tier supply base (Rhys, 1996). This transfer of responsibility has important implications for these firms and their local economies. For example Sleigh (1991; p6) notes *"success will be dependent on the determination to pursue R&D on an increased scale. Not to do so could deprive a component manufacturer of its ability to grow or even survive"*.

The next section of the paper outlines some key characteristics of the automotive industry in Wales. Section three examines R&D issues for the automotive industry, focusing on NPD. Section Four presents results of a survey of first tier automotive component suppliers and NPD activity. Policy issues relating to the extent and nature of the NPD in Wales are outlined in Section Five.

2. The Automotive Industry in Wales

The motor industry plays an important role in the Welsh economy in terms of employment, output and income provision. The industry in Wales is concentrated in the South, along the M4 corridor, and in the adjoining valleys as far west as Llanelli, and in the north along the A55 around Flint and Wrexham. Figures regarding the size of the industry vary between sources, largely because of the difficulties in classifying sector activity. For example, many companies that make automotive components will be allocated, for official data collection purposes, to the plastics industry, or to electronics, rather than to the defined motor components sector. Annual Employment Survey data for 1997 suggest that some 15,000 people are employed in the defined motor vehicles and trailers sector (which will exclude some companies allocated to other sectors, such as plastics), around 7% of the Welsh manufacturing total. A significant proportion of this employment, over two thirds, is in foreign-owned plants (Welsh Office, 1998). Harman (1996) however estimated (using a broader definition, including many second and third tier suppliers) that around 25,000 people were employed in 150 component firms in Wales, generating £2 billion in sales.

The motor industry has been targeted by the WDA as part of its inward investment policy, and as part of its 'Source Wales' initiative. In addition, the industry has received significant amounts of regional grant aid such as Regional Selective Assistance (RSA). Since 1981, 16% of the RSA total of approximately £800 million offered to industry has been awarded to the automotive and transport equipment sectors. Of this, around 50% has been awarded to non-UK firms, particularly US firms, but also Japanese and European companies.

Over the past 20 years the motor industry has experienced a number of changes, particularly in terms of the relationships between the car assemblers (Ford, GM, Rover, etc.) and their direct first tier suppliers. The changes taking place in the Welsh automotive component industry should be viewed in the wider context of the shift from the mass production to the lean production paradigm. This aims to eliminate "waste", defined as any activity which adds cost but not value, through the compression of lead times in design, development and supply. Vehicle manufacturers are concentrating on their core strengths of powertrain, vehicle assembly, and integration of constituent sub-systems within the bodywork, styling and marketing (Rhys, 1996). Hence, first tier suppliers are increasingly taking on responsibility for designing and supplying the complete system, as opposed to just the components. In 1980 all of the major European assemblers manufactured their own water pumps in-house. In contrast by 1990 only VW-Audi retained any capability in this area. In 1980 all of the assemblers had at least some internal production for exhaust systems, while a decade later there was none. Similar observations apply to brakes, seats, and fuel tanks.

In moving towards this new paradigm the automotive industry has undergone a number of changes, particularly at the automotive component supplier level. These have centred on the restructuring of buyer-supplier relations towards less confrontational approaches, with a smaller number of key first tier suppliers. This has led to a reduction in numbers of direct suppliers to vehicle manufacturers. Between 1986 and 1992 Ford in Europe reduced its supply base from 1250 to 1000, General Motors from

Table 1: Examples of First Tier Suppliers in Wales

Company	Product	Location
Allied Signal	Spark Plugs	Treforest
Calsonic	Radiators	Llanelli
Coopers Filters	Air & Oil Filters	Abergavenny
Exide Batteries	Batteries	Cwmbran
Gillet Exhaust Manufacturing	Exhaust Systems	Tredegar
Robert Bosch	Alternators	Llantrisant
Trico	Windscreen Wipers	Pontypool
TRW	Steering Systems	Neath
Valeo Climate Control	Air Conditioning Systems	Swansea

2000 to 1200, and VW from around 1700 down to 1200 (Lamming 1993). These companies also instigated the creation of a tiered supplier base, in which the first tier suppliers (also known as "full service" suppliers) are having to take responsibility for designing systems as well as managing the supplier chain below.

3. NPD in the Automotive Component Industry

R&D, and more particularly New Product Development (NPD), are becoming more important to supplier competitiveness. Within the analysis of research and development activities as a whole, the OECD uses three definitions. Basic, fundamental or 'pure' research is undertaken for the advancement of knowledge without a specific practical application in view. Applied research develops ideas into an operational form whilst experimental development uses results from basic and applied research, leading to the introduction of new materials, products, and processes (OECD, 1994). NPD as defined within this study falls primarily into the latter two categories. The significance of these areas is highlighted by Patel and Pavitt (1995), who report that firms on average spend three times more on development activities (designing, building, testing prototypes and pilot plant), than on research activities (developing, testing and refining scientific laws and models).

Just as manufacturing was the focus of the competitive advantage debate in the 1980s and early 1990s, researchers such as McGrath (1996) and Clark and Wheelwright (1995) now see NPD as the new competitive battleground. Indeed, it appears logical that since 60-80% of a product's cost is determined by its design (Hartley and Mortimer, 1991) that this activity should command attention. An effective NPD process contributes a host of benefits to an organisation. It can increase company revenue through extended product life cycles and increased market penetration. It can also provide improved product development resulting in shorter development cycle times, less development waste and better use of resources (McGrath et al, 1992).

As well as benefits in product quality and cycle time, high quality NPD processes are associated with reductions in scrap and re-work, thus improving manufacturing productivity and throughput time (Cooper, 1993). Of all the benefits accruing from effective NPD, saving time is widely thought to be the next source of manufacturing competitive advantage. Indeed, this simultaneous reduction in both time *and* effort which prompted Womack *et al* (1990) to suggest that "faster is dearer", will ultimately join "quality costs more" as an outmoded concept.

Within NPD itself there are a range of activities, depending on the degree of new technology and new ideas introduced. At one end of this continuum is "breakthrough product development", which seeks major gains over competitors and may lead to a redefinition of the product. "Incremental product development" may add new features to an existing product or seek to reduce costs of products already in production. "Derivative product development" generates add-on products for those already in the marketplace. To complete the continuum, some firms will undertake no NPD at all, relying on customers or other firms for product development.

In order to understand problems arising in the process, McGrath (1996) analysed over 100 product development projects in numerous companies. The research highlighted deficiencies in the development processes of many firms, within the areas of decision making, organisational structure, product strategy, management of technology and use of problem solving tools. Patently, therefore, the emphasis is on effective NPD, rather than merely its undertaking per se. A review of various previous research highlights a number of recurring themes which form the backbone of successful NPD activities within world class companies. These are summarised in Table 2 below and examined further in Section Four.

Table 2: Best Practice in NPD

Technique	Description
Identification of customer needs	Precise definition of the product is required early in the NPD process, necessitating close liaison with the customer throughout the development programme to ensure that customer needs are identified and met. If utilised correctly, the QFD process can be a useful tool here.
Supplier Involvement	Early involvement of component suppliers can create a source of competitive advantage when integrated into and seen as an extension of the NPD team.
Team Approach and Structure	For complex projects, teams should be cross functional with members drawn from various departments within the organisation, and empowered to make decisions and take action. These "heavyweight" project management or autonomous team structures are typically more effective than a "lightweight" or functional approach.
Concurrent Engineering	Concurrent engineering is required to ensure that all aspects of product and process are developed in synergy. This allows downstream processes to have an upstream presence, thus reducing the risk of difficulties occurring during the later phases.
Project Phases and Reviews	Project phases and reviews allow the monitoring of progress and performance. Effective reviews are important for decisions on resource requirements, and can also facilitate senior management involvement.
Application of Tools and Techniques	Planning tools can provide information on activities, timings and project milestones. When used effectively, analytical techniques such as QFD, FMEA, DFM ensure potential design and process problems are detected and resolved. Finally, CAD, FEA, and Rapid Prototyping are tools which can be effective in reducing time-to-market.
Senior Management Support	Successful organisational initiatives require senior management support. Senior management should be guardians of the NPD process, establishing a link between business strategy and product development strategy.

• CAD Computer Aided Design • DFM Design for Manufacture • FEA Finite Element Analysis •
• FMEA Failure Modes and Effects Analysis • QFD Quality Function Deployment •

4. The Welsh First Tier Automotive Industry and New Product Development

A survey of the first tier automotive component industry in Wales was undertaken in the Summer of 1998 to examine both the nature and extent of NPD (and hence, the likelihood of retaining first tier status). The methods employed in undertaking NPD were also analysed, in order to assess the use of best practice techniques. A postal questionnaire was sent to all 70 first tier automotive component suppliers in Wales, identified from WDA records.

Table 3: Industry Structure

Turnover	Respondents (%)	1990 (Delbridge et al) (%)
Under £10m	36	61
£10-20m	25	19
Over £20m	39	20
	n =37	n =56

Responses were received from 37 companies, with no obvious non-response bias. The Annual Employers Survey figure of 15,000 automotive employees is the best available estimate of the size of the first tier in Wales. The combined employment total of all responding firms then represents just under 50% of the first tier total. Interviews were also undertaken with five respondents, selected to represent a range of products, firm size and location, in order to obtain in-depth information on the NPD process.

Comparison of this study with an earlier survey of firms in Wales "known to supply original and replacement equipment to the automotive industry" by Delbridge et al (1990) reveals a population with fewer smaller firms, and more large ones (Table 3). Moreover, 75% of the respondents were UK-owned in the 1990 survey, compared with 46% in the later survey. The 1990 survey reported that 32% of respondents derived less than 50% of their turnover from the automotive industry. One explanation for the differences observed may therefore lie with the specific industry definition. For example, the earlier survey is likely to have included a greater number of sub-contracting and machine shop operations comprising smaller, single site, and domestically-owned firms, which may no longer supply the assemblers directly.

The respondents manufactured a range of products. For example, 19% of these firms produced automotive body parts, 28% produced steering components, 17% made interior fittings or equipment, and 44% manufactured engine parts. Other products included suspension components, electronic components and braking parts. The product classifications used in this study were not directly comparable to the Delbridge study (1990), however, the distribution of products were broadly in-line with those of the Boston Consulting Group report (1991), which related to the UK automotive components sector as a whole.

The Welsh component suppliers' customer base was concentrated in the UK on Rover, which provided business for 67% of respondents. However respondents also supplied Honda, Ford, Jaguar, General Motors, Nissan, Toyota and Peugeot in the UK. The distribution of customers was broadly consistent with the earlier Welsh study. The main difference between the two studies was an inferred increase in business from the Japanese assemblers over the last decade- particularly from Honda.

Finally, this study suggests that there has been an increase in the proportion of firms achieving recognised quality standards. For example, half of respondents to the 1990 survey achieved BS5750, compared with over 85% of the present study who had ISO9000 (the latest BS5750). In 1990, 40% of suppliers had Q1 or Q101 status (Ford quality standards); 51% now have QS9000 (the modern day industry standard). In addition, 32% are now RG2000 (Rover Group quality assurance) accredited.

The survey showed that some forms of NPD were being undertaken by firms even though they did not have a specific R&D function. Table 4 shows the type of functions being undertaken whilst Table 5 shows the types of NPD occurring at Welsh sites.

Whilst only 41% of respondents had a specific research function within their plant, over 60% were carrying out at least incremental NPD, and over 40% were carrying out breakthrough NPD. However, one would expect at least some incremental NPD to be undertaken on site as part of the ongoing manufacturing process. Thus the fact that 32% of firms were not undertaking any NPD was disappointing, given its increasing importance as a competitive weapon. The perception of a "branch plant syndrome" in Wales has developed from the presence of firms which lack these important higher level functions at the local level. Historically, Wales has a poor R&D record, with spending per head some 60% below the UK average (Regional Trends, 1998)

Of those companies not undertaking NPD at all at their Welsh site, all but 3 stated that their Welsh site was for manufacturing only, with just under a third of firms stating that they did not undertake NPD in Wales because their company had centralised the R&D function elsewhere. The overwhelming view was that company policy precluded local NPD, albeit with one firm citing the lack of skilled labour as a reason.

The use of best practice techniques in

Table 4: Functions undertaken at Welsh Sites

Function	% of Companies with function on Welsh Site
Design Engineering	70
Finance	87
Industrial Engineering	73
Manufacturing	100
Marketing	54
Purchasing	92
Quality	100
Research	41
Sales	70

NPD in Welsh companies was addressed by examining the extent to which best practices identified in Table 2 were recognised and utilised by the firms in Wales. The outcomes are shown in Table 5.

The majority of the respondent companies undertaking NPD both recognised and more importantly employed the best practices indicated above. This was particularly true for analytical techniques such as FMEA. However, a number of problems were highlighted. Firstly, 40% of survey firms had not undertaken QFD- the technique for objective evaluation of customer requirements.

Similarly, 40% companies undertaking NPD did not use concurrent engineering techniques, despite the fact that this was widely recognised as a desirable practice by interviewees. Multi-functional teams were widely employed for NPD projects, although 16% of firms were still taking a purely functional approach. However, of the companies employing a team approach over a third had a "lightweight" project manager, while a further 30% had a matrix or "medium weight" system (i.e. lying between the functional and autonomous extremes). Only one firm used an autonomous team or "heavyweight" project management approach.

These results are of some concern, as lightweight project managers have little responsibility for, or authority over, the people assigned to work in project teams. The functional leaders ultimately retain the real power. This structure is not suited to the more complex products increasingly found in the automotive industry, which require high levels of cooperation between functions, rather than just coordination of their activities. Inappropriate team structures can thus be the source of conflict over resources and project ownership. These findings tie in with the relatively low observed implementation of project phase review structures (72%), procedures which are vital for successful time management and resource allocation.

5. Policy Issues

A third of surveyed automotive component firms undertook no NPD at all. This is of potential concern to the long term future of the Welsh component industry in particular, and to the economy in general. For the firm, NPD must be seen as a crucial competitive weapon, while for the economy as a whole the high quality nature of employment in these activities relative to that found in the more basic manufacturing processes must be a paramount consideration. Policies aimed to encourage increases in the numbers involved in research and development activities in the Welsh economy are fundamentally important. The reality and perception of Wales as a low labour cost, assembly-only location needs radical alteration, via education, training, and the development of indigenous expertise in NPD which exploits all existing resources, including those of the higher education sector. Unlike production activities, this is an area to which Foreign Direct Investment (FDI) is less likely to contribute, at least initially, because of Wales's poor historical record for R&D. However, the DTI's new emphasis on technology as a means of promoting competitiveness, combined with the Regional Technology Plan (WDA, 1998) provide an opportunity for development in this area. Additionally, many of the firms are located in areas which now qualify for Objective One funding.

A large share of firms in the Welsh automotive component industry *are* undertaking NPD, but they may not be employing fully best practice techniques. This fact appears to have been acknowledged by many firms, which suggests that the WDA may find a receptive audience to policies developed in this area. Clearly management of change is crucially important and expertise from the WDA could prove helpful in the dissemination of best practice.

6. Conclusions

The Welsh automotive component industry is important to the Welsh economy. The changes in the automotive sector, with the additional responsibilities being passed down the supplier chain, particularly in terms of NPD, create both opportunities and threats for the industry in Wales. Firms and policymakers need to work together if the sector is to prosper in the new Millennium.

Table 5: Types of NPD undertaken at Welsh Sites

Type of NPD Undertaken	% of companies undertaking type of NPD at Welsh Site
Breakthrough	43
Incremental	62
Derivative	11
No Product Development	33

Table 6: Recognition and Usage of Key NPD Best Practices

NPD Best Practice	% of Firms Recognising Best Practice	% of Firms Using Best Practice
Cross-functional Teams	96	84
Concurrent Engineering	84	60
Phase Reviews	92	72
FMEA	100	96
QFD	88	60

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