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Regional Policy, Competitiveness And Inward Investment: R & D In The Welsh Auto Components Industry

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Abstract

Over the past three decades Wales has been quite successful in replacing employment lost in traditional heavy industries by developing manufacturing sectors such as automotive components. The attraction of inward investment has been a key factor in this. However, Wales is still relatively weak in areas important to long term competitiveness, notably Research and Development (R&D), an issue which we suggest has not as yet received adequate policy response from the Welsh Assembly Government. This paper therefore examines issues relating to new product development in the Welsh automotive component industry. The central questions addressed are; to what extent is New Product Development (NPD) happening within these firms? What conclusions can be drawn regarding changing regional development policy response within Wales?

Keywords : R&D, Wales, Automotive Components, New Product Development

Introduction

From the 1970s through to the 1990s, the prime objective of economic development policy within Wales was essentially the replacement of the tens of thousands of jobs lost within the traditional heavy industries. The Welsh Development Agency (WDA) was established in 1976, with its key objective being the attraction of inward investment in order to achieve this end. During this period, it had some significant success, with £14bn of inward investment secured over the last two decades (DTI figures). The Agency has been particularly successful in attracting and developing industrial clusters in the sectors of automotive components and electronics. By the mid 1990s around one quarter of employment in Welsh manufacturing was located within these sectors (Moyes and Thomas, 1996), as was 36% of employment in foreign-owned manufacturing.

The last ten years has, however, seen a reduction in traditional Foreign Direct Investment (FDI) coming into Wales and the UK in general, as other locations (Eastern Europe, China) are increasingly able to offer packages consisting of economic incentives and adequately skilled workforces but with significantly lower labour costs. Moreover, a number of existing FDI projects have recently either experienced significance job losses or exited the Welsh economy completely (Cooke and Clifton, 2005).

Although it should be noted that in this more difficult climate Wales has generally continued to attract levels of investment proportionally greater than its share of the total UK population, in the longer term a largely inward investment employment-based development strategy would appear unsustainable for the Welsh economy. Even if such an option were available, recent years have seen growing concerns expressed regarding relative levels of prosperity within Wales, which have remained static or even fallen relative to the rest of the UK despite nearly thirty years of FDI job creation (Shipton, 2003). This issue was given explicit recognition when significant areas of Wales were granted Objective 1 status, i.e. funding designed to boost lagging regions of the European Union (those with GDP per head of 75% or less of the EU average) for the period 2001 to 2006.

It is therefore becoming apparent that a key problem for the Welsh economy is that, in general, it is still relatively weak in the higher value-adding activities that are

important for long term regional competitiveness (Porter, 2003). Among these activities, Research and Development[i] (R&D) plays a significant role (Brooksbank and Pickernell, 1998; Phelps et al, 2003). R&D strategy underpins existing and future new product development (NPD) and provides the necessary resources.

More generally, the contribution of R&D to productivity and growth is well documented in the literature (see for example Barell and Pain, 2001; Parisi et al, 2002; Smith and Barfield, 1996), has been borne out by recent evidence (OECD, 2001), and is now seen as a key driver within UK competitiveness policy (DTI, 1998; Porter and Ketels, 2003). Research and Development is accepted as a cornerstone of what has become known as the 'knowledge economy', in which the competitive edge derives from dynamic improvement rather than static price-based competition (Cooke, 2002).

As such, the purpose of this paper is to examine R&D activity in Wales, in the context of changing forms of regional policy response. In order to do this, we focus specifically upon the management of NPD in one of the most significant sectors of Welsh industry; the first tier automotive component industry (i.e. those component firms supplying directly to the vehicle assemblers). The advantage of this industry-specific approach is that it allows the kind of targeted information gathering not practical in more general survey methodologies. Moreover, NPD in automotive industry is becoming increasingly important as a means of achieving competitive advantage. Vehicle manufacturers are focusing on their core competencies; transferring significant responsibility for component design and development to their first tier supply base (Clifton, 2001). The successful transfer of this responsibility therefore has important implications for practitioners within these firms, and ultimately for the regional economies in which they operate.

The central questions to be addressed are therefore:

- To what extent is NPD happening within these firms?
- To what extent are recognised best practices being employed?
- What does this mean for regional development policy in Wales?

The next section of the paper outlines some key issues regarding regional development policy and the nature of manufacturing investment in Wales. Section Three examines R&D issues for the automotive industry, focusing on NPD. Section Four outlines research aims and method, while section Five discusses results of a survey of first tier automotive component suppliers and NPD activity. Section Six draws conclusions, for practitioners, and more generally for present and future policy response and its role in integrating NPD as part of a regional development program.

The Welsh Context

The motor industry plays an important role in the Welsh economy, employing nearly 14,000 people in the "motor vehicles and trailers" sector (SIC 34), around 7.8% of the Welsh manufacturing total (Annual Business Inquiry, 2003). There are no vehicle assemblers located within Wales. According to Rhys (2002), the component base consists of around 150 firms; 110 of which are first or second tier suppliers, with the remainder operating lower down the supply chain. The vast majority of these are in 'parts and accessories'. Using a wider definition of the automotive industry, which included second and third tier suppliers producing basic and generic parts, Harman (1996) estimated that around 25,000 people were employed in 150 component firms

in Wales. Although these numbers are probably lower now, in all probability they will still be significantly higher than the 14,000 of the narrow definition. The industry is concentrated in the South, along the M4 corridor in the adjoining valleys as far west as Llanelli, and in the north along the A55 around Flint and Wrexham.

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. Ford opened an engine plant in Bridgend in 1978, and this was followed by investments in Calsonic, Valeo, Lucas-SEI, Bosch, Trico, ITT-Alfred Teves, Ina Bearings, Sekisui, Yuasa, Gillet, Grundy and Hoesch-Camford. Some of these (including Valeo and Lucas) have since retreated. From 1999, the Bridgend plant became the sole source for Zetec engines, and in recent years new engine ranges for Jaguar and Toyota have entered production. However, despite becoming increasingly capital-intensive, the automotive industry in Wales still lags behind the UK in terms of productivity (Cooke, 2004).

In addition to the direct impact (increased employment, improved trade balance), the diffusion of management and production knowledge is also a well documented potential consequence of FDI (Young et al, 1994; Brand et al, 2000). In the UK automotive industry the establishment of the Japanese car assembly transplants was seen as a major opportunity for the UK industry to improve techniques through such resource transfer (Jones, 1999). Indeed, there is evidence that foreign multinationals in general and Japanese multinationals in particular have brought their superior techniques with them to the UK (Morris et al, 1993). Specifically, Morris et al found that in all of the Japanese companies in Wales that they visited managers were familiar with Japanese production methods and had successfully introduced 'Just in Time' (JIT) and 'Total Quality Management' (TQM) philosophies. Pickernell (1997) found that beneficial resource transfer (of new working practices) was taking place between the Japanese car assembly transplants and their UK suppliers through learning effects which aided the introduction of practices and techniques associated with "Just in Time" production. There is also evidence of resource transfer occurring in Wales via the labour market, through employment of staff who previously worked in other, multinational companies in the region, as well as via physical proximity giving the opportunity for visits (Pickernell, 1998). Furthermore, Cooke and Morgan (1998) highlight the role of regional clusters in facilitating development of the informal or soft infrastructures important for successful innovation. Wales's concentration of FDI in the automotive sector gives ample opportunity to utilise these mechanisms. However, much of the empirical evidence is less positive regarding the consequences of inward investment, finding low levels of local sourcing (Phelps, 1993; Turok, 1993), a limited degree of resource transfer through the supply chain (Crone and Roper, 1999), and typically a lack of advanced R&D facilities (Foley and Watts, 1996). These are the classic problems of the 'branch-plant' model of FDI, in which a lack of engagement with the host economy is in turn driven by the affiliate's subordinate role within the wider company group (Hudson, 1999).

As noted in the previous section, despite the influx of heavily grant aided FDI, Welsh manufacturing is still afflicted by weaknesses in a number of areas believed to be of importance to competitiveness. Specifically, Brooksbank and Pickernell (1998) found that Welsh manufacturing was relatively deficient in skills, a competitive supply base, and most notably research and development.

While accounting for only 5% of the UK population, Wales has in recent years secured on average 11% of manufacturing inward investment projects in the UK, which have been responsible for 15% of new jobs in this area. This is contrasted with the attraction of only 3% of inward investment in R&D over a similar time period (Jones and Osmond, 1999). More generally, R&D spending as a whole is far lower in Wales; only 1.1% of UK business R&D was undertaken in Wales in 2001 (ONS, 2002). Moreover, Wales has the lowest proportion of R&D workers of any UK region, involving just 0.17% of the labour force as compared to a UK average of 0.49% (Jones-Evans, 2002).

Roberts (1996) found that almost 77% of employees in foreign firms operating within Wales were classified as operatives or assembly workers. This compares to the UK FDI average where operatives account for only 60% of employment. It is clear therefore that FDI in Wales is not relatively concentrated in higher paid, higher skilled non-manual occupations, such as those that characterize the research and development process.

Roberts also found in her survey of foreign firms that over 60% of respondents did not have any R&D functions at their Welsh facilities. Consistent with this figure, 42% of Welsh respondents to Phelps et al's (2003) survey were carrying out 'on-site research for new products'. This has potentially serious implications for the long term viability of the Welsh automotive components industry, and for the wider economy of an already lagging region. Moreover, as Cantwell (1989) points out, functions such as R&D are separable from other production functions and tend to be attracted to areas already strong in research activities, creating a vicious circle for those without a strong research record. As an aside, these jobs tend to be more highly skilled and better paid than those purely in manufacturing.

From the above it can be concluded that despite the positive effects of FDI noted in terms of employment and improvements in manufacturing practices, Wales has been a subject of the branch-plant economy model, particularly with regard to the lack of domestic R&D carried out by inward investors. Thus, for the best part of two decades the WDA pursued a policy of reclaiming derelict land near areas of high employment, building advanced factories, and marketing Wales globally and using incentives to persuade foreign (and UK) firms to establish manufacturing branch plants. As described above, this met with some success.

The 1990s however began to see a gradual realisation of the need to moderate this approach, in response to the changing competitive climate. This reflected a wider shift in focus towards developing indigenous capacities, skills, innovation and entrepreneurship; these 'Lisbon agenda' priorities were embodied in the DTI's (1998) Competitiveness White Paper, and ultimately with specific reference to Welsh policy in the 'Winning Wales' strategy document (Welsh Assembly Government, 2002). This document has however subsequently been criticised as being largely aspirational and lacking in detail in terms of mechanisms for actual delivery (Porter, 2002). At the micro level, the WDA since the mid-1990s did seek to facilitate vertical and horizontal networking through its Supplier Associations programmes, and there is evidence that this (albeit limited) focus on developing 'soft infrastructure' has met with some success (Cooke and Morgan, 1998; Izushi, 1999)

In 1999, devolved government came to the UK with the establishment of the Scottish Parliament and the Northern Ireland and Welsh Assemblies. Each body has varying degrees of power but all three have primary responsibility for the design and delivery of economic development policy. A full review of these policies is beyond the scope of this paper, but one of the key initiatives for achieving knowledge economy

development in Wales, and to which significant resources have been committed (£260m, largely from Objective 1 funds), is the Technium programme. These are essentially sector-specific incubators (an automotive Technium is due to be located in Llanelli although construction has not yet begun), and in keeping with WDA policy appear to be a continuation of the 'real estate' approach to economic development. The Techniums are intended to facilitate knowledge-based start-ups and spin-outs. Doubts exist regarding how realistic this initiative is (Jones-Evans, 2002), but even if it proves entirely successful, it is thought unlikely to directly aid the higher level functions (including R&D) within pre-existing larger firms. These appear to be neglected in current policy and yet this is where the bulk of manufacturing industry employment is still to be found.

Reviewing post-devolution economic development policy in Wales, Cooke and Clifton (2005) conclude that this has essentially been 'precautionary' in approach and often preoccupied with reorganising the administrative apparatus. The functions of various quangos (including the WDA) are due to be absorbed into the Welsh Assembly Government as of April 2006 with poor performance being cited as the chief reason for this (Barry, 2005a; Shipton, 2005). The suspicion remains of expedient institutional reorganisation driven by lack of viable alternative options, given the limited powers of the devolution settlement (Shipton, 2005).

NPD In The Automotive Component Industry

Over the past 20 years, as motor vehicles become progressively more complex and requiring the integration of increasingly diverse technology systems, it has become more efficient for the vehicle manufacturers to concentrate on their core strengths while delegating other areas to a select group of chosen suppliers (Burt, 2000; Clifton, 2000). In contrast, mass production projects typically made only modest use of suppliers' design and engineering capabilities, while relying more heavily on the use of common parts. The core strengths of the vehicle manufacturers can be summarised as being in powertrain, final assembly and the integration of the constituent sub-systems, within the bodywork, styling and marketing concepts (Rhys, 1996). Key suppliers are therefore taking on a greater role in the other areas of motor vehicle production, increasingly supplying complete systems rather than individual components (Clifton, 2001). In addition to utilising their suppliers' manufacturing expertise in these areas, more significantly the assemblers are shifting design and development responsibility to the first tier, and thus increasingly relying on the suppliers' NPD capabilities. First tier suppliers accounted for over 60% in 2001, which is an increase of one third over the 5 year period studied by Oliver and Primost (2003). The management of NPD in the automotive industry, and specifically within first tier suppliers, is therefore an important source of regional competitive advantage and one warranting more in-depth investigation.

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' or 'radical' product development, which seeks major gains over competitors and may lead to a redefinition of the product. A less risky strategy is 'incremental' product development. This evolutionary approach may involve adding new features to an existing product or seek to reduce costs of products already in production. This concept is commonly found in the car industry whereby a number of models share the same transmission and framework systems etc. (Meyer and Utterback, (1993).

'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.

McGrath (1996) analysed over 100 product development projects in numerous companies in an effort to gain understanding of the problems associated with the process. 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*. Distilling the work of various researchers (Clark and Wheelwright, 1995; Coombs et al, 1998; Cooper and Kleinschmidt, 1992; De Meyer, 1996; Dimancescu and Dwenger, 1996; Dooley et al, 1996; Doz, 1996; Jones, 1997; Reger, 1999) serves to highlight a number of recurring themes which form the backbone of successful NPD activities within world class companies. These are summarised below:-

- **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. The Quality Function Deployment (QFD) process is a useful tool here and was used as the key indicator in the survey.
- **Team Approach and Structure**: Ideally project teams should be fully cross-functional with members drawn from the various departments of the organisation to ensure a balanced NPD procedure in a matrix structure whereby cross-functional team members have a reporting relationship to both the project manager and the functional leaders. Particularly for complex projects, team leaders need to be empowered to make decisions and take action. These 'heavyweight' project management structures operating within a strong matrix organisation are typically more effective than a 'lightweight' or functionally based approach. Within these two extremes is the 'programme coordinator' who manages a project but does not have direct responsibility or authority over resources.
- **Concurrent Engineering**: Concurrent engineering is required to ensure that all aspects of product and process are developed in synergy. Concurrent approaches were essentially introduced by the Japanese motor industry as a component of the 'lean production' system and allows downstream processes to have an upstream presence, thus reducing the risk of difficulties occurring during the later phases. Concurrent engineering also minimises the duration of the project via its critical path hence reducing time-to-market..
- **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 may also facilitate senior management involvement.
- **Application of Tools and Techniques**: When used effectively, the key analytical technique of Failure Mode and Effect Analysis (FMEA) ensures potential design and process problems are detected and resolved. In addition, Computer Aided Design (CAD), Finite Element Analysis (FEA), and Rapid Prototyping are tools that can be effective in reducing time-to-market.

While the dangers of prescribing a 'one size fits all' model of best practice are appreciated (Coombs et al 1998), the factors described above were felt to be those most appropriate for gauging NPD in first tier automotive component manufacturers and these were consequently examined in the research.

Research Aims, Data And Methodology

A survey of the first tier automotive component industry was undertaken in order to examine both the extent and nature of NPD carried out in Wales within this sector. The methods employed in undertaking NPD were also analysed in order to assess the use of best practice techniques. Definitions of these were included on the questionnaire to minimise problems of interpretation. Comparisons were also made between UK and non-UK owned firms, to examine evidence of branch-plant effects of past inward investment projects in the area of R&D, and also between those firms supplying the UK-based Japanese assemblers and those which did not, for evidence of the transfer of working practices highlighted earlier also occurring in the area of R&D management.

Finally, relationships between NPD success and the use of best practice, quality accreditation, nationality and customer base were explored. The determination of NPD success is important in informing best practice and may ultimately serve as an input to the NPD process. There is therefore a need to also have some measure of its output. Given the diverse nature of products and processes within the sample firms, it was decided that respondent assessment (on a Likert type scale) would be an appropriate way of rating a company's overall NPD performance. While criticisms of the potentially subjective nature of this approach are acknowledged, this method was felt to be the best option available given constraints over time, resources and access to sensitive commercial information.

A postal questionnaire was sent to all 70 first tier automotive component suppliers in Wales, as identified from WDA records. Responses were received from 37 companies, with no obvious non-response bias. If the figure of 14,000 automotive employees highlighted earlier is taken as the best indicator of the size of the first tier in Wales, then the combined employment of responding firms is just under 50% of this, thus indicating good coverage from the survey. Interviews were also conducted with five respondents, selected to represent a range of products, firm size and location, in order to validate questionnaire responses and obtain further information on the management of NPD.

Comparison of our study with an earlier survey of the 85 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. It is acknowledged that a number of smaller firms may still be in existence, but no longer supplying the assemblers directly. This is to be expected in view of the greater "critical mass" now needed in order to sustain first tier status, which includes the resources to invest in fully in R&D. Moreover, 75% of the respondents were UK-owned in the 1990 survey, compared with 46% in the later survey, highlighting the internationalisation of the industry in Wales. In both surveys, US ownership was the most common within the foreign-owned firms.

The respondents manufactured a full range of automotive products. For example, 19% of these firms produced 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.

Respondents supplied Rover, Honda, Ford, Jaguar, General Motors, Nissan, Toyota and Peugeot in the UK.[ii] The distribution of customers was broadly consistent with the earlier Welsh study. The main difference between the two studies was an increase in business from the Japanese assemblers over the last decade, particularly from Honda. This picture further warrants the investigation of resource-transfer issues in the management of NPD within automotive suppliers.

Results And Discussion

This study suggests that there has been an increase in the proportion of firms achieving recognised quality standards among first tier suppliers in Wales. For example, half of respondents to the Delbridge et al (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. No significant differences were found between UK and non-UK owned firms in terms of quality accreditation. Interestingly, there was no apparent link between the possession of quality standards and success in NPD. However, an association was observed (at the 95% level of confidence) between quality standards and the use of best practice as defined in this study[iii]. This finding might imply that quality accreditation is a useful input measure of the NPD process, but does not say much about the actual output. This suggests that a new (or at least modified) certification procedure is required in this area. Conversely, the situation observed may be due in part to how NPD "success" is gauged in this study. This is clearly an area for further research, particularly to explore the linkages involved in translating NPD inputs (i.e. resources, best practices) into outputs- i.e. successful new products. Table 1 shows the type of functions present whilst Table 2 shows the types of NPD occurring at Welsh sites.

Table 1: Functions undertaken at Welsh Sites

Function	% of Companies with function on site		
	UK owned	Non-UK owned	All firms
Research	35	45	41
Design Engineering*	82	60	70
Industrial Engineering	65	80	73
Manufacturing	100	100	100
Quality	100	100	100
Purchasing	94	90	92
Marketing**	76	35	54
Sales**	88	55	70
Finance	82	90	87

Table 2: Types of NPD undertaken at Welsh Sites

Type of NPD Undertaken	% of Companies undertaking type of NPD on Site		
	UK owned	Non-UK owned	All firms
Breakthrough	41	45	43
Incremental*	71	55	62
Derivative	18	5	11
No Product Development*	24	40	33

Interestingly, foreign-owned firms have a significantly lower presence of both sales and marketing functions. This provides some confirmation of the branch-plant hypothesis, and may also have an impact on NPD in that the lack of these activities makes it more difficult to be "close to the customer" in the development of new products in practical terms, for example staff representation on multi-functional project teams. The significantly greater presence of 'design engineering' in domestic firms and the higher proportion of overseas firms undertaking no NPD at all in Wales provides further support for the branch plant scenario. Overall, 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% claimed to be 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 33% of firms undertake no NPD at all is a matter for concern given its increasing importance as a competitive weapon[iv], or indeed as a survival strategy in the longer term: "*Theoretically, it is possible for a firm to survive without any significant development to its products, but such firms are exceptions to the norm*" (Trott, 2002:173).

As anticipated, table 2 shows a higher proportion of overseas firms undertaking no NPD of any description. Non-UK firms were also engaged in lower levels of activity in the incremental and derivative categories. Similar levels of breakthrough research activity were reported for both sets of supplier. It should be noted however that differences were not observed above standard levels of statistical significance, so some caution must be placed in interpretation. The small sample size is a limiting factor here. However, even if we conclude that overseas firms are no different to their domestic counterparts in this respect, they are at best reinforcing an existing problem. As highlighted earlier, Wales has a poor R&D record, both in terms of domestic activity and inward investment projects.

Of those companies not undertaking NPD at all at their Welsh site, all but three 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.

An important finding of this study, which confirms the value of examining the use of best practice in NPD is the association found between NPD success and the use of best practices (at the 95% level of confidence). In addition, regarding the need for a 'critical mass' in order to sustain an R&D effort, larger firms (defined as those with over 200 employees) were found to be significantly (at the 95% level) more likely to utilise best practices although they did not rate their NPD as more successful than that of the smaller firms[v]. As with quality standards, this is interesting in that it is the

NPD input that is emphasised, rather than the output (i.e. new product success). This could be due to the indicator used, or could highlight a problem in translating efforts into results- although as noted above- the overall use of best practice is associated with increased NPD success. Clearly future research is needed in this area- i.e. is this a 'Wales effect' or a more general R&D management issue?

The use of specific best practice techniques in NPD in the sample was addressed by examining the extent to which the activities identified in section 3 were recognised and utilised by respondents. The outcomes are shown in Table 3.

Table 3: Recognition and Usage of Key NPD Best Practices

NPD Best Practice	% of Firms Recognising Best Practice			% of Firms Using Best Practice		
	UK owned	Non-UK owned	All firms	UK owned	Non-UK owned	All firms
Tools & Techniques (FMEA)	100	100	100	92	100	96
Customer Needs (QFD)	85	92	88	62	58	60
Concurrent Engineering	92	75	84	62	58	60
Cross-functional Teams	92	100	96	77	92	84
Phase Reviews	92	92	92	62	83	72

As can be seen from table 3, the majority of the respondent companies undertaking NPD both recognised and adopted the majority of best practices. This was particularly true for analytical techniques such as FMEA. Some areas of concern are highlighted, for example 40% of firms did not currently employ QFD; the technique for objective evaluation of customer requirements.

Similarly, 40% of companies undertaking NPD did not use concurrent engineering techniques despite the fact that this was widely recognised as a desirable practice by respondents. When utilised effectively, concurrent engineering facilitates integration across functional boundaries, a key criterion for successful NPD (Coombs et al, 1998). Conversely, sequential demarcation can lead to segments of a project being "finished" by one area before moving on to the next. Problem solving can thus be a complex procedure, with much communication devoted to backtracking and the apportioning of blame. In addition, the earlier involvement of downstream participants may also serve to enhance the "buy-in" of all functions to an NPD project. Therefore the relatively low level of implementation in this area is a matter of concern and one that needs to be addressed by both managers themselves, and at a higher level by Government bodies such as ELWa (Education and Learning Wales) and the WDA.

Given its contribution to effective NPD, it is encouraging that the majority (84%) of respondents employed some form of cross-functional team in their NPD projects (the management of these teams is examined below). Less encouraging however is the relatively low observed implementation of project phase review structures (72%), procedures which are vital for successful time management and resource allocation.

With respect to nationality and the recognition and use of best practice in NPD, a greater use of teams and of phase review procedures was observed in non-UK firms. Non-UK firms also averaged higher best practice scores in NPD. The fact that no significant differences (at standard levels of confidence) were detected between UK and non-UK owned firms could again be a reflection of the relatively small sample

size involved in this study. As such, a more detailed investigation of these specific best practice areas, possibly on a case study basis or indeed a UK wide sample, may be rewarding.

Table 4: Project Management Approach

Type of Project Management	% of Companies employing type of project management		
	UK owned	Non-UK owned	All firms
Functional**	38	10	25
Coordinator**	15	64	38
Matrix	38	27	33
Autonomous team	8	-	4

* significant at the 90% confidence level
** significant at the 95% confidence level

Table 4 indicates that a considerable number of firms (25%) are still adopting a functional approach to NPD project management. Of the other companies employing a team structure, 38% had a 'coordinator' project manager, while a further third utilised a 'matrix' system (i.e. lying between the functional and autonomous extremes**)**. Only one firm used an autonomous team or 'heavyweight' project management approach.

Most significant within these results is the greater inclination of UK-owned firms to employ a purely functional project management approach. This is of some concern as lightweight project managers have no 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 (Reger, 1999). Conversely, although also unlikely to utilise an autonomous or a matrix approach, overseas firms are much more likely to employ a coordinator or "medium weight" project management system, which may well give them an advantage over their domestic counterparts in this area.

Finally, no association was detected between supplying Japanese customers and the success of a firm's NPD activities, or indeed with the utilisation of best practices in NPD. This is interesting in that it contrasts with the literature relating to the transfer of other beneficial working practices in the area of manufacturing / assembly (JIT, TQM, etc) in Wales (Morris et al 1993; Pickernell 1997). This suggests that either resource transfer is less effective in the area of NPD than it is for manufacturing techniques, or that this is not a priority for the first tier suppliers (and more to the point their customers) included in this study. More research may shed light on this issue.

More generally, though positive impacts have been reported from inward investment these are by no means universal. Recent research show that several caveats may apply such as nature of the entry to the host region (acquisition, greenfield, etc.) the proximity and relationship between customers and suppliers, and so on. (Brand et al 2000; Phelps et al 2003; Potter et al 2003 ; Williams 2003) . Addressing these issues was however beyond the data and scope of this study.

Conclusions: Implications For Policy And Further Research

A third of surveyed automotive component firms undertook no NPD at all. This is broadly in line with the findings of Phelps et al (2003), who revealed that only around half of FDI companies in both Wales and North East England show R&D activity (our definition of R&D is wider, including incremental and derivative activities). This is of some concern to the long term future of the Welsh automotive component industry in particular and to the economy in general. This has consequent impact on employment considering the high quality nature of employment in these activities relative to that found in the more basic manufacturing processes. Policies aimed to encourage increase in R&D activities are therefore fundamentally important. This approach has met with some success in peripheral economies such as the Republic of Ireland.

Specifically for Wales, the reality (and perception) of the region as a low labour cost, assembly-only location needs addressing 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 FDI is less likely to contribute, at least initially, because of Wales's poor historical record regarding R&D. To some extent this is a legacy of the branch plant investments of the past in which (as we have shown), lack of local NPD was often a matter of company policy. This is a situation that economic development policy in Wales has been slow to address. There is however recent evidence from the Welsh consumer electronics sector that a successful shift from manufacturing only to integrated R&D activity is possible (Smale, 2003). Moreover, a shift towards more flexible corporate structures within multinational firms would suggest greater opportunities now exist for autonomy at the level of local plant management (Pike, 1999).

The DTI's increased emphasis on technology as a means of promoting competitiveness, combined with the full implementation of the WDA's 'Regional Technology Plan' and the more recent 'Innovation Action Plan' provide an opportunity for improving R&D performance. These issues are increasingly appearing on the political agenda in Wales (Barry, 2005b).

Additionally, many of the firms are located in areas that now qualify for Objective One funding. Within the objective one programme is the target of achieving 2% of UK R&D expenditure by 2006; priority 2 measure 3 is specifically designed for this purpose. To date £40m has been allocated but this is quite small in the context of the overall programme. In the short term it may be sensible to adopt the schemes administered by Finance Wales (the loans and equity funding body established by the Welsh Assembly and the WDA) in conjunction with the new Assembly Investment Grant to assist development in this area. In the longer term, there is a need to consider integrating R&D support in the context of a wider Regional Science Policy (Jones-Evans, 2002). Such a policy will need to address the issue of increasing the collaboration between industry and the Welsh Higher Education Institutions, and improving collaboration *between* the HE Institutions themselves. It is also important to recognise that many larger firms are increasingly out-sourcing their R&D activities to specialist suppliers; as such the role of these smaller (typically indigenous) firms needs to form part of any science based development strategy.

A large share of firms in the automotive component industry *are* undertaking NPD but they may not be employing fully best practice techniques. This has potentially serious implications given the association found between the use of these techniques and

NPD success. Also of concern is the apparent failure to translate learning effects from Japanese customers in terms of working practices into the area of NPD**.** This suggests that the WDA may find a receptive audience to policies developed in this area. Furthermore, it is clear that management development issues will be crucial in this respect, and again expertise from the WDA / ELWa could prove helpful here in the promotion of best practice. The WDA's 'Supplier Association Programme' has been quite successful in promoting inter-firm cooperation (Izushi, 1999) and this might represent an opportunity to transfer best practice *horizontally*, i.e. between first tier automotive suppliers. Similarly, the Accelerate Wales programme (a £100m joint venture between the WDA and the Welsh Automotive Forum) is a further step in the right direction, facilitating the transfer of best practice by the cross-placement of 'guest engineers' within companies at various stages in the automotive supply chain. On a note of caution however, given the impending absorption of the WDA, ELWa and various other quangos into the Welsh Assembly Government, there are inevitably question marks regarding how the new arrangements will work, and ultimately whether the capability for designing and delivering policy solutions that are less 'precautionary' and more 'visionary' will exist.

A case in point is the observation that although UK owned firms are more likely to carry out NPD, they are less likely to utilise certain best practices than their overseas counterparts which *do* carry out NPD. The clearest example of this being in the area of NPD project team management. As such it would be interesting to investigate the possible differentiation of overseas firms between 'no NPD' firms and 'good practice NPD' firms. This implies clear opportunities for learning and the transfer of best practice (which this study suggests are undeveloped at present) that could be exploited by policy-makers, but also by R&D managers themselves. Finally, the association found in this study between the use of best practice and NPD success sends a clear message to firms and practitioners of the need to implement these structures fully within their organisations.

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[i] Whilst there are many definitions available, this paper assumes the standard OECD definition of R&D as 'creative work undertaken systematically to increase the stock of knowledge of man, culture and society and the use of this knowledge to devise new applications'.

[ii] Since the time of writing, MG Rover has experienced a well-documented collapse. It is estimated that 22 component suppliers in Wales are effected (Western Mail, 2005).

[iii] A best practice "score" was calculated for each firm based on the number of these that they utilised (i.e. 0 to 5). A difference of means test was then carried out with the sample split between those firms with QS9000 accreditation and those without.

[iv] Delbridge et al (1990) found that 38% of component suppliers in Wales undertook no R&D. This is a comparable figure given the differences in survey methodologies, and would suggest little evidence that rapid NPD growth has occurred during the 1990s.

[v] The NPD success and best practice result was obtained by carrying out a difference of means test on the best practice score, with the sample split between "high success" (successful / very successful on the questionnaire) and "low success" firms (unsuccessful / quite successful). A similar procedure was adopted for the large firms result.