IMPLEMENTING SUPPLY PRACTICE AT BRIDGEND ENGINE PLANT

The influence of institutional and strategic choice perspectives

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The authors gratefully acknowledge Bridgend Engine Plant and Ford Motor Company for their assistance during this research.

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Abstract

Purpose – This paper investigates the stalled adoption of a supplier park at Bridgend Engine Plant in the UK. It starts from the position that not all firms can or should implement the same set of practices.

Design/methodology/approach – Critical Incident Technique and semi-structured interviews over 5 years were used to understand the influence of institutional and strategic choices during the implementation of a supplier park. A conceptual framework was developed to incorporate practices broadly associated with parks i.e. improving supply stability, supply coordination, redefining the OEM/supplier boundary and enhancing interaction between co-located firms.

Findings – The findings demonstrate a limited implementation of supply practices at Bridgend with only one component supplier brought onto the site. The original plan was to create a supplier park that would 'grow' to an industrial park, creating an automotive sector in the area. However, a combination of operational, processual, and contextual factors have conspired against the plan.

Research limitations/implications – The combination of a broad range of theoretical and practical elements means there are associated discussions that could be more fully explored. Condensing the interview notes has resulted in the researchers own interpretation of events becoming a significant reality filter. Whilst single case studies raise inevitable concerns over comparability, our focus is on theoretical generalizability through richness of empirical data.

Originality/value of the paper – As firms continue to use best practice as a core ingredient of strategy, researchers must respond with robust theoretical concepts explaining adoption and implementation. This paper integrates disparate perspectives across multiple levels in order to build a richer and more believable picture of a stalled initiative. Three key conclusions can be drawn: the contingent nature of 'bundles of practice', implications of political ambiguity over the efficiency argument and the effect of isomorphic or bandwagon responses by firms.

Keywords: Best practice, supplier parks, isomorphism, engine manufacture, innovation

Paper type: Research paper

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Introduction

More than a decade has passed since Ford, the global automotive firm, first suggested creating an industrial park on a site adjacent to its engine plant in Bridgend, South Wales. The land available is not Ford land, the majority is owned by the Welsh Development Agency. This factor was critical because public funding could not be attracted to a supplier park purely for the benefit of Ford alone. The plan, therefore, was to attract tier 1 and 2 automotive suppliers, plus service providers, onto the site with the ability to supply product not only to Ford, but to any other customer. This was the critical difference between a single-OEM dedicated supplier park and an automotive industrial park. The initial attraction was for current Bridgend Engine Plant (BEP) suppliers to be the first inhabitants, and create a supplier park that would 'grow' to an industrial park with the long-term goal to create an automotive sector in the Bridgend area. Yet despite considerable effort from BEP, the implementation of the park began to deviate from the original concept at stage one.

Dedicated sites such as supplier parks, where component suppliers decentralise production to units located close to assembly plants (Millington et al., 1998), have rapidly established themselves as best practice (Hayes and Wheelright, 1984; Schonberger, 1986) in the automotive sector. During the 1990s for instance, most Original Equipment Manufacturers (OEMs) including Ford, General Motors, Fiat, Peugeot, Renault, BMW and Volkswagen, implemented or were in the process of implementing some kind of supplier park initiative e.g. there are currently 23 in Europe and 35 Worldwide. Such widespread adoption (Cullen, 2002; Larsson, 2002; Chew, 2003; Reichhart and Holweg, 2005; Howard and Miemczyk, 2006) would seem to suggest, a priori, that the nature and benefits of this practice are well understood by practitioners. Yet against this backdrop of automotive sector isomorphism (DiMaggio and Powell, 1983), the Bridgend plan of an initial supplier park remains predominantly a plan rather than a place. Most strikingly, all the infrastructural amenities and access roads are in place, there is even a logistics

provider available to ship components to the nearby engine plant, but there is only one low value (literally 'nuts and bolts') supplier on site. In seeking to increase our theoretical and practical understanding of how complex and multi-faceted practice is adopted and adapted, this apparent lack of first steps in the supplier park race is particularly interesting. Given that the decision has been taken and repeatedly endorsed to implement a supplier park at Bridgend, the timeframe associated with the case mean that it provides unusual access to the normally hidden routines (Jones and Stevens, 1999) associated with stalled or failed practice adoption. Equally, the case presents an unusual set of operational factors and organizational context that allow for further criticism (Sousa and Voss, 2001) of universalistic approaches to practice applicability. While not seeking to develop a full-blown contingency approach (e.g. Utterback and Abernathy, 1975; Miles and Snow, 1984), the paper argues that the successful implementation of supplier park practice will depend upon some combination of operational (e.g. Hayes and Wheelwright, 1979), organizational process (e.g. Pettigrew, 1985; Johnson, 1987) and broader contextual (e.g. McKone and Schroeder, 2002) characteristics.

The paper is structured as follows. First, there is an examination of the literature whereby the operational supplier park concept is described as a bundle of discrete practices, and extant processual and contextual perspectives on practice adoption are summarised. Second, the critical event research method and the case study are introduced. Third, the analytical core of the paper deploys the conceptual schema to seek operational, processual and contextual insights from the Bridgend case. Finally, the implications for theory and practice are presented in the conclusion.

Defining the conceptual framework

The existence of a profitable market for fashionable management ideas (Abrahamson 1991; 1996) goes a long way to explaining the endless search for axiomatic practice principles (e.g. Womack and Jones, 1994). At the same time there is, at least amongst most researchers, a growing acceptance that few discrete practices or bundles of practice can ever deliver universal competitive value. Resource/capability-based theory for

example, offers an implicit yet powerful critique of much research directed towards establishing 'best practice' (Powell, 1995; Laugen et al., 2005). If it is the *unique* aspects of an organisation that create long-lasting advantage, the suggestion that factors *common* to several firms can be sources of success is problematic. This paper starts from the position that not all organizations can, or should, implement the same set of practices (Galbraith, 1977).

Models of strategic choice

A growing number of empirical studies suggest that practice innovation and adoption relates to specific - disembodied and asocial - organizational characteristics such as firm size (White et al., 1999), plant age, unionization status (Shah and Ward, 1995). Less empirical attention has been given, perhaps because of the predominance of survey based research methods, to those organizational factors emerging from the interactive and socially complex behaviours associated with the strategy process (Pettigrew, 1985; Johnson, 1987; Orlikowski, 2000; Brown and Duguid, 1991; 2001). Corporate politics, for instance, is an inescapable fact of life for most managers (Buchanan and Badham, 1999) yet it is rarely discussed in the predominantly rationalist models of practice adoption. Moreover such factors may be particularly significant when considering 'boundary spanning' (e.g. Dollinger, 1984; Ibarra, 1993; Rosenkopf and Nerkar, 2001) change initiatives such as a supplier park. Interestingly, although empirical observation would suggest that there is a minimum scale (in terms of supplier base, capital availability, market power, human resources, etc) necessary to even begin to consider adopting a supplier park initiative, it has long been noted (e.g. Chandler, 1962) that the 'bureaucratic burden' tends to be more onerous in larger organizations. Likewise, evolutionary economics (e.g. Aldrich, 1979; Nelson and Winter, 1982) suggests that the longer the experience an organization has with certain practices, the harder they are to replace (Pil and MacDuffie, 1996). In other words, processual variables can create inertial forces (Hannan and Freeman, 1984) sufficient to adversely influence the implementation of even the most technically rational practices.

The operations literature makes regular reference to the decision areas addressed explicitly or implicitly in the medium and long-term management of operational resources. In strategy process terms, such typologies represent an 'intermediate' conceptualization: not seeking to determine or translate fundamental market or resource priorities, but rather offering a useful summary of the scope of the management task. The earliest variants delineated manufacturing strategy decisions (i.e. plant/equipment, planning/control, organization/management, labour/staffing, design/engineering) and these continue to influence the categories used by operations strategy authors. Over time, as Operations Management broadened, the decision areas have multiplied with the inclusion of, for instance, quality systems and supply chain decisions (Hayes and Wheelwright, 1984; Fine and Hax, 1985). Increasingly, operational practices are seen as affecting performance, not as individual elements, but conceptualised as interrelated and internally consistent 'bundles' (Macduffie, 1995; Shah and Ward, 2003).

Another significant driver of new practice adoption is the so-called 'bandwagon' effect. A bandwagon is a diffusion process where organizations adopt innovations because of external pressure caused by the large number of organizations that have already adopted, or are considering adopting, the concept (Tolbert and Zucker, 1983) and not because of any rational efficiency argument of the practice. In some cases, companies still adopt new methods even after they have assessed them as highly inefficient and likely to cause losses, due to bandwagon pressures (Abrahamson and Rosenkopf, 1993). Typically, the pursuing legitimacy (Scott, 1995) leads to the adoption of a practice because management is more concerned about being perceived by customers, suppliers, investors and competitors as industry laggards, than any real fears about misapplying the practice. Following the lead of other organizations (whether right or wrong) is often the simplest way forward, especially when innovations are new or not well-understood (March and Olsen, 1976). These arguments call for inclusion of this perspective, established in the Institutionalist School, within the mainstream operations thinking of practice adoption.

The supplier park as 'bundle of practice'

The bundle of practices associated with supplier parks broadly include improving supply stability, supply coordination, redefining the OEM/supplier boundary and enhancing interaction between co-located firms (Cullen, 2002; Larsson, 2002; Chew, 2003; Sako, 2003; Reichhart and Holweg, 2005; Howard and Miemczyk, 2006). While some of the practices correspond with established manufacturing approaches, especially in the lean context (Shah and Ward, 2003), others offer a distinct supplier park trait (Table 1).

Insert Table 1: Practices adopted at European supplier parks

Typically the supplier park concept is introduced as an experiment in an emerging market first and implemented in the home market later. Volkswagen was arguably the first, building an industrial estate close to the Seat plant for 15 suppliers in Spain (1991), followed by a series of initiatives in Brazil, including Volkswagen's Resende plant (1997), General Motor's Blue Macaw project (2000) and Ford's Amazon Project (2002). Supplier parks represent shared proximity yet distributed ownership, which means clustering suppliers under the same roof or in separate buildings and investment in land, buildings and facilities shared with the OEM (Sako, 2003). In terms of international trade and regional economic development, supplier parks are subject to different interpretations. Sako (2003 p1) summarizes these views as either *'clusters with all the goodness of a locally embedded production system [*or*] …an ultimate tool by multinational corporations to de-territorialize and control the global commodity chain'*.

Supply Stability

Problematically a daily assembly schedule and vehicle assembly sequence is of little use where suppliers are located thousands of miles away, work to long delivery lead times, and are subject to frequent supply interruptions or disturbances (Svensson, 2000). In 1992 for instance, Seat moved their main assembly plant from the suburbs of Barcelona to an industrial district 50 kilometres away and simultaneously opened the Abrera supplier park. Today the park is home to 32 suppliers, embarking 63 'in-sequence' component sets on their final 10 minute journey to 3 different vehicle assembly lines almost one thousand times per day. This 'risk management' notion has been presented as a primary

factor influencing the adoption of supplier parks (Cullen, 2002) yet it is unclear whether bringing suppliers close to their customer manufacturing sites does indeed reduce these types of disturbances.

Supply coordination

Supplier co-ordination activities mould suppliers into a common way of working so that competitive advantage can be gained, particularly by removing inter-company waste (Hines et al., 2000). One approach to improving coordination has been proximity, for example *'successive production stages are located in close proximity to one another to improve coordination and economize on inventory and transportation costs'* (Dyer, 1996 p.273). However, such site specificity has widely known problems related to the transaction cost argument of asset specificity (Dyer, 1996). The activity of coordination is also simplified through supply consolidation and rationalisation of the bill of materials, despite the fact that this often pushes the coordination effort further upstream (Cousins, 1999). This practice is widely seen in assembly plant supplier parks where only modules are delivered in sequence, as opposed to sub-components (Sako, 2003; Reichhart and Holweg, 2005). Other practices to improve coordination include inventory management initiatives such as Vendor Managed Inventory (VMI), a common aspect of automotive supplier parks (Howard and Miemczyk, 2006).

Value chain configuration

General supplier park literature describes a range of activities at the boundary between OEMs and suppliers, from pure warehousing to full vehicle assembly. Problems of levels of vertical integration are neatly summarised in the Fisher body case. Klein et al., (1978) describe the dealings that culminated in a vertical merger in the 1920s between General Motors and Fisher Body, a leading supplier of the new style of closed auto bodies. An exclusive dealing arrangement significantly reduced the possibility of GM acting opportunistically by demanding a lower price for the bodies after Fisher made the specific investment in production capacity. Unfortunately, these pricing provisions did not work out in practice. The shift in demand from open towards closed-style bodies meant GM was unhappy with the price it was being charged by its now very important

supplier. Fisher refused to locate their body plants adjacent to GM's assembly plants, a move GM claimed was necessary for production efficiency but which required a large and very specific investment on the part of Fisher. Finding the contractual relationship intolerable, GM began negotiations for purchasing the stock of Fisher Body, culminating in a final merger agreement in 1926.

The degree to which post-contractual opportunistic behaviour occurs is dependent on how specific the assets are to the transaction, and therefore how difficult it is to write contracts accounting for all contingencies. If supplier facilities at supplier parks have highly specific assets (i.e. physical, human, and site-related) then the risks of opportunistic re-contracting is higher (Millington et al., 1998). Specific assets can also lead to strategic inflexibility, as the OEM is dependent on the co-located supplier. This issue was summarised by one automotive supplier as *'while the set-up fosters a long-term partnership, it reduces flexibility in quality or cost disputes'* (Cullen, 2002).

Enhanced interaction

Many advocates of supplier/OEM proximity refer to softer benefits such as enhanced communications and better knowledge-sharing (Dyer and Singh, 1998). Interestingly, related work exploring the benefits of industry clusters suggests that this kind of rich knowledge exchange can underpin the development of specific, additional, capabilities (Saxenian, 1994). More than two decades ago, Schonberger and Gilbert (1983) argued that the success of JIT practised by firms implementing lean principles was strongly associated with geographically proximate suppliers. However, recent research has shown that this is not always the case (Wafa et al., 1996). Specifically, information communication technologies are able to mitigate the effects of distance on successful just-in-time practices defined as reductions in inventory, component rejects, and delivery lead time (Lee and Whang, 1998).

Reichhart and Holweg (2005) further reinforce the positive elements of enhanced interaction through sharing of confidential wage information (between all parties on a supplier park) and inventory information (between OEMs and suppliers). The former ensured that wage equalisation stopped opportunistic bargaining by employees, and the latter, reduction in inter-company waste.

Thus far, this discussion of supplier parks as a bundle of practices adopted by automotive OEMs is helpful in assessing the extent to which the bundle is adopted. While current descriptions of supplier parks are mostly limited to automotive assembly parks, the concept of this bundle of practices appears to suit, at least conceptually, a variety of manufacturing environments where flexibility and responsiveness of supply are critical (for an alternative example see the description by Slack et al (2004) p.79 of Flextronics). It is argued that the practices are sufficiently generic (not vehicle assembly plant specific) to warrant application to this case. Yet there are always situational specifics, and thus further theoretical variables are now examined to shed light on why practice bundles are adopted either as a whole or partially.

Impact of contextual variables upon supplier park adoption

Curiously, although the management literature is replete with examples of how environmental factors such as region, industry and economic conditions impact on organisational performance (e.g. Lawrence and Lorsch, 1967; Swamidass and Newell, 1987; Grant and Gregory, 1997; Ahire and Dreyfuss, 2000), organisational context has traditionally been missing from specific discussions of practice adoption (Shah and Ward, 1995; Voss and Blackmon, 1998; Ward and Duray, 2000). This is particularly problematic when considering the diffusion of a practice like supplier parks which is an essentially network phenomenon, heavily influenced by globalisation, market power, and conformity pressures. There is a macro-literature concerned with factors, such as regulation, that can lead to sectoral isomorphism, or common practice (e.g. DiMaggio and Powell, 1983) but, as Sousa and Voss (2001) highlight when reviewing studies of TQM adoption (arguably the richest practice literature), there have been few rigorous and explicit (and fewer still empirical: see Benson et al., 1994) attempts to *'raise the possibility of QM practices being context dependent'* (p384). Moreover, the contextual variables that are cited (e.g. industry, country, company size, plant type, etc) lack the specificity that will readily translate to either theory development or practical prescription. For instance, most supplier parks are automotive initiatives, several have been successfully created in the UK, and perhaps most intriguingly, Ford itself has had supplier park success in other parts of its global network. As a further illustration of the

need for a finer grained perspective on context, the need for physical supply security (i.e. avoiding shrinkage) caused by the characteristics of 'higher risk' operating environments or the explicitly political work of accessing state aid in its various forms, are key contextual factors largely missing from discussions of supplier park initiatives to date. Yet public actors through state aid have a significant role to play in establishing suitable infrastructure (Peck, 1996).

The Bridgend Engine Plant (BEP) and supplier park initiative

Ford Motor Company announced plans to build an engine plant at Bridgend in September 1977. This was considered important to the economic development of the area, where the £180 million capital investment by Ford attracted £115 million of government assistance through job creation and regional grant schemes. Bridgend was selected to be the main supplier of engines to the British-based companies in Ford's Premium Auto Group (PAG) founded in 1999, chiefly because of the favourable road and rail links to the rest of Britain. Engines from Bridgend are now supplied to Land Rover, Jaguar as well as traditional 'blue oval' Fords. Supplying PAG, including overseas customer Volvo in Sweden, will significantly increase engine production and raise total plant output to around 1 million engines per year by 2010 (Figure 1). In order to achieve the extra capacity requirements and manage the additional engine variety, Ford has looked at how it handles materials coming into the factory. As part of a £240 million investment, the company investigated the building of a new de-consolidation facility and the location of a supplier or 'industrial' park adjacent to the engine plant to house suppliers for the new engines.

Insert Figure 1: BEP production volume 1979 – 2009

The introduction of the PAG engines will increase the plant's product range, expanding not only the level of engine variety but also resulting in considerable component complexity. There are three engine types currently built at Bridgend: the V8 Engine for Jaguar and Land Rover, and the Sigma and SI6 engines fitted in blue oval Fords. Building PAG engines has added another 4 engine types to the plant's output, in addition to current Ford and Jaguar engines. The proposed PAG engines raise significant concern

over the increase in the level of planning and operational complexity. The additional PAG customers mean the engines will be used in 9 distinct vehicle applications. Considering there are 3 base engine architectures, variations in aspiration and displacement mean that there are 25 distinct varieties of finished engines. When options for regional and operational differences are added, the result is that engine variations will grow from a total of 4 in 1979, to an estimated 44 available in 2009, supplied to 9 customer locations across Europe (Table 2). Although the engines will be all built together at one facility, each customer demands specific characteristics such as the leaping cat or blue oval logo on oil filters and casings for their engines to maintain brand image. The following sections outline the Ford BEP plans and objectives for the supplier park.

Insert Table 2: BEP product variety 1979 – 2009

Facilities

The organisation of facilities at BEP is driven by the need for production flexibility, in a plant that is space constrained, as well as cutting costs by sharing investments with partners such as the Welsh Development Agency (WDA). This led to the proposal to use adjacent land for materials management and supplier production. In order to encourage suppliers, the space was badged 'industry park' to encompass dedicated and non-dedicated facilities and BEP management negotiated with the WDA to locate suppliers close to the plant with a link 'through the fence'. At the same time the proposal comprised a deconsolidation and sequencing logistics centre to manage BEP's lengthy supply lines of deep sea shipments (e.g. from Korea).

Suppliers and partners

Only five companies considered the option to locate satellite facilities at the plant: a number described by Ford as *'not yet reaching critical mass'*. The problem for Ford is how to persuade suppliers that they will benefit by locating next to the engine plant. Providing a local logistics centre will enable Ford to improve management of complexity from the new engines. Plant management at Bridgend consider the logistics centre to offer a number of potential benefits:

- Manage the flow of materials into the plant
- Sequence parts and collate engine kits
- Provide an inventory buffer for suppliers unable to ship daily

Apart from the logistics supplier, Ford also needed to attract those suppliers providing the more complex components and sub-assemblies that will vary between brands and engines. The greatest improvements in operational efficiency will be the result of attracting suppliers which late-configure components to deliver in-sequence, compared to those providing localised warehousing for non-complex parts. The later value is added to components related to the build sequence, the greater the benefits not only to the company but also to the effect on the development of the local community.

Investment

The proposed development at Bridgend will involve an investment in the region of £240 million (not only for the supplier park). The WDA has applied for funding to the value of £17.4 million from the European Community to assist with the project in the form of regional and training aid. Securing funding for the project will help prevent production of the new engines being allocated to the alternative North American site proposed by Ford. This is done by equalising the cost differences in production (although the hidden costs of US sourcing have not been explicitly included in the estimates).

Logistics

As production areas are at a premium within the factory, 'non-value adding' space for warehousing and materials management that serves as a line feed kanban cannot expand and in fact BEP looks for opportunities to decrease this where possible. As part of the new supply strategy, BEP planned to use a logistics specialist to deliver component kits to line side 'in sequence' from a de-consolidation and sequencing centre. This specialist would manage suppliers on a 'bulls eye' basis, with first tier suppliers close by (on the park), and lower tier suppliers further a-field. Although Ford adopts conveyor systems in other supplier parks, to deliver from suppliers to the assembly line, the lack of component volumes (size and quantity) does not merit this approach. However, BEP anticipates

entrusting movements to the logistics specialist to rationalise traffic flows of inbound and outbound products in the face of increased volume and complexity.

Production

To ensure smooth operation of the production plant for the new engines, the plant must be sequenced upstream of final vehicle assembly with the suppliers. To avoid holding excessive stocks of PAG engines, the trigger for the build sequence must come from the assembly plant on a need-only basis. The current engine line up at BEP does not require this level of coordination across the supply chain. While all PAG partners are answerable to Ford, sequencing the final build requirements across multiple geographically dispersed sites with Bridgend means coordinating tier 1 and tier 2 suppliers may prove to be difficult. This is further complicated by the volatility of current production patterns which often deviate from the forecast. A critical aspect of production at BEP is the management of labour. While expansion will increase headcount, the introduction of a supplier park is likely to force a reconsideration of job roles within the plant. The company faces difficult decisions over how to outsource internal logistics responsibilities to suppliers or logistics providers.

Research method

A detailed case analysis of the attempt to create a supplier park at Bridgend forms the empirical core of the paper. Case studies are particularly useful when exploring new areas of research (Voss et al., 2002; Stuart et al., 2002, Eisenhardt, 1989) and equally, the rich qualitative and quantitative data sets generated (Yin, 1994) are particularly important because the measurement of intangible phenomena e.g. roles and relationships (Denzin and Lincoln, 2005) was a central concern. Studies of single organizations or sectors remain popular in management research because they offer the opportunity for deep, longitudinal analysis, exploring the impact of organizational change (Tyrrall and Parker, 2005) and often involve the development of conceptual frameworks or interpretative schemes (Mueller et al., 2003).

Primary data was collected using semi-structured interview questions, each interview lasted between 1.5 and 2.5 hours, investigating the sub-elements defined by the conceptual model (i.e. operational, processual and contextual factors) and the respondent-driven Critical Incident Technique (CIT) (Flanagan, 1954; Bitner et al., 1990; Edvardsson, 1992; Mattsson, 1993; Johnston, 1995). The former aims at a global case description and understanding of the behaviour of firms over time, whereas the latter is used to map micro-level incidents as individual respondents experience them. For this purpose we defined an event to be *'a retrospective organisation of a set of inter-related incidents into a comprehensive narrative'* and for an event to be classified as 'critical' meant that it *'was perceived to have had a positive or negative outcome for a person or the organisation'*. A chronology of activities by Ford leading up to and after the decision to build the BEP supplier park was created as a guide to familiarise the investigators with contemporary events at the site (Appendix A).

Insert Table 3: Supply practice research

A total of 20 different interviews were carried out with senior management and supporting regional staff in charge of this and parallel supplier projects. In terms of number of interviews per category, this consisted of senior managers at Ford Europe (n = 6), managers of the supply operations asked to participate in the supplier park (n = 11), and representatives from the regional development agency (n = 3), see table 3. This permitted access to three distinct relationships: (a) between BEP and Ford Corporate; (b) between BEP and those suppliers who were to be the first major participants in the supplier park, and; (c) between BEP/Ford and the regional agency. To improve the reliability and validity of the results, the outline findings (including potential differences of interpretation) were presented back to interviewees, giving participants an opportunity to question the findings and the conclusions drawn. In selecting potential sites, random sampling was neither necessary, nor even preferable (Eisenhardt, 1989), especially as connecting different levels and units of analysis is a central concern of this research. This non-trivial conceptual and methodological hurdle is ameliorated by the restricted focus on a single case faced with the issues of increasing volumes and variety, the adoption of a

single practice bundle (the supplier park) and one specific sector (automotive). Moreover, several other Ford sites have supplier parks (e.g. Valencia, Cologne) and Bridgend managers sought to adopt this practice as an important part of their own strategy to cope with increasing pressures from their customers, including other divisions within Ford.

Findings

The findings demonstrate a very limited implementation of supplier park practices at BEP (Table 4). These can be summarized as bringing one supplier (BBB Hardware) close to the site using a dedicated warehouse. The supply of goods was consolidated from 32 suppliers to 1, and with JIT supply implemented from the warehouse to the BEP internal store. Cooperation between the supplier and sub-suppliers now exists to discuss future design changes on hardware only.

Insert Table 4: Practices adopted at BEP

Supply Stability

An original goal of BEP was to create supply stability by bringing suppliers physically closer and creating dedicated non-OEM space. The regional funding grant provided by the WDA to develop the park at Bridgend was conditional in that the site had to provide a hotel and a leisure centre to serve the local community as well as needs of the engine plant: *'we wanted it next to the fence'* (Supply/Operations Manager). This broadly fitted with the thinking at BEP in 1999, although some negotiation was required over who was to provide the park infrastructure: *'they [*the WDA*] were a tad reticent, but its happening now'* (Senior Manager).

The approach stipulated by the WDA and fully supported by BEP was to adopt the idea of a general industry park, not just a supplier park. '*Government grants are critical to the success of a plant like Bridgend in South Wales ... There are lots of plants with over-capacity and grants play a big part in deciding where new programmes go*' (Development Agency Representative). The driver for BEP was that manufacturing space within the plant is valuable and hence the need to *'fill the space with value-added'*

(Supply/Operations). The prime cost driver is labour hours per engine, therefore BEP want to reduce this in any way possible by *'taking hours away from the engine'* (Supply/Operations). Yet supplier parks have had a chequered history at Ford, such as the Saarlouis plant that forced suppliers onto the site and then increased component prices. Despite the well-established supplier park trend BEP was determined to be different, offering suppliers the option to move to Bridgend whether the additional capacity was to serve Ford or a competitor: *'...it's a voluntary process, so the supplier can provide for other customers as well as BEP'* (Supply/Operations). However, the uptake by suppliers to locate to the park has been minimal: *'we were unsuccessful'* (Senior Manager).

Since the original visit to the Ford Valencia supplier park by BEP managers and the WDA in 1999, there have been considerable political pressures and institutional barriers to overcome. Central to the case is the proposal for the Bridgend site being different because the intention for an industrial park as opposed to a supplier park. The land adjacent to the plant is owned by the WDA, although it was agreed that it would be largely automotive: *'Ford cannot dictate who or what went on the park'* (Development Agency). The decision to open the industrial park to all suppliers was intended to attract EU funding. The catalyst for Ford was the emergence of the PAG engine strategy to consolidate in Bridgend, Sweden or Cleveland (US), or buy in engines from another source. WDA were anxious to present an overwhelming case for why a potential $400 million investment should come to Bridgend in Wales and commissioned a study by a leading consultancy.

Yet the WDA and BEP struggled to gain the internal support needed from senior Ford management until meeting with the President of Ford of Europe, David Thursfield, in the autumn of 2000. He conditionally agreed with the strategy for BEP, but only on a case by case progression, i.e. it had to be a sound business case and profitable. Unfortunately, events unfolding elsewhere across the company overshadowed the plans for Bridgend. Major restructuring in Europe and the closure of the Dagenham vehicle plant rightly commanded senior management's attention and the plan did not receive adequate internal support.

Supply coordination

The impending uplift in production is primarily due to the increase in demand by Ford for the PAG engines, which includes different variations in power and durability for Jaguar, Land Rover and Volvo. The creation of Ford's premium vehicle segment has impacted on BEP because *'PAG will give us complexity'* (Supply/Operations). This means the level of model variety is set to increase significantly, from 19 types of engine produced at present, to an estimated 44 by the end of the decade. This introduces considerable inventory cost implications, difficulties in terms of space, and managing the stocks of parts needed to maintain supply to the BEP engine lines.

The inherent difference across BEP customers also introduces the issue of coordination. Volvo will give short-term changes, for example: the next day's schedule is firm, but next week will change. Ford gives a level and fixed schedule where the first 10 days are firm. *'Ford is a suit off the peg [*whereas*] Volvo is made to measure'* (Senior Manager). Land Rover will also affect BEP because it is looking for a 50% increase in volume, so they in turn are seeking to increase supplier capacity. However, components such as wire harnesses are supplied from the Philippines and involve a 16-week lead time, which means the schedule must be modified immediately.

Supply consolidation/rationalisation

Ford, Jaguar and Volvo purchasing and supply organizations were at the time under great pressure to secure cost savings under the Team Value Management (TVM) banner instigated by Thursfield, but there was not a centralised commitment and the three Purchasing organisations *'could never get a joint act together'* (Supply/Operations). Organizational hierarchy meant economies of scale could never be realised across a potential 1 million units per year at Bridgend. Criteria such as inventory costs (owned by the plant), freight costs (owned by no-one), quality (absorbed by the plant), and continuity of supply (a cost consequence to the plant) *'were all overridden by immediate piece cost advantages owned by purchasing'* (Supply/Operations). The local implementation of rationalising only hardware (nuts, bolts and fasteners being non-

strategic) simply reinforces the position that joint economies of scale could not be made across PAG as a whole.

Improved inventory management practice (e.g. VMI), JIT and JIS supply

There is considerable debate between managers at Volvo and other PAG partners on flexibility. This follows the argument that supports building-to-order, a concept that Volvo has developed over the past 15 years. Volvo uses its own 'chimney model' for suppliers whereby there is little margin on sales of new vehicles that are common specification models, and higher margins on vehicles that are less-common specification. This means there could be a 150% change in the production schedule, so Volvo looks to install flexibility in suppliers to vary manufacturing levels on a monthly and weekly basis, using local warehouses to cope with this variability. However, Ford adopts a different approach, preferring to run production using a levelled schedule. There is '*a philosophical battle between Volvo and Ford'* concerning which approach takes precedence: build-to-order or make-to-stock (Senior Manager).

Furthermore, the demands of PAG on Bridgend means complexity is growing, particularly as these luxury vehicles tend to be more customer-driven than the traditional mass-market approach by Ford. Even the approach to dealing with PAG components is different than BEP has been used to in the past. For example, wiring harnesses from Japan normally involve a 4 week pipeline due to sea freight. They are product-specific where even wire length differentiates it from other engine types. Ideally the final operation of cutting the wire is left until the plant, but as BEP doesn't do this it must pay for premium airfreight to cope with fluctuations in demand.

These issues combined would suggest a great need for flexibility through new inventory management practices. Surprisingly, the implementation of these practices is limited only to hardware that is not particularly influenced by variability in demand. Senior management appears not yet to have accepted the challenge for specifying how to manage long-distance supply chains.

Value chain re-configuration

BEP felt it was offering suppliers an opportunity when it came to deciding the type of operations to co-locate, *'it was up to the supplier to decide'* (Supply/Operations). However, BEP was looking for particular types of suppliers:

- Major castings i.e. heavy and expensive items
- Select fit parts e.g. tappets currently required in 50 different lengths so they could machine it overnight and deliver next day
- Wiring harnesses i.e. late product differentiation overnight
- Hardware e.g. nuts and bolts. This seemed counterintuitive, but represents one of the few successes of the industry park. Whereas before there were 32 shipping points of 237 part numbers, now there is just 'BBB'.

The business case for the industrial park was to preserve high value added at BEP. In reality, the park is bound to be predominantly 'a warehouse', but supply chain complexity is now reduced as a result of dealing with one hardware company and a logistics provider who currently represent the sole occupiers of the site. BEP wanted to have minor sub-assembly and sequencing activity carried out by suppliers. At present it has plans for a line-feed of hardware, including washing of dunnage, picking, packing and sequencing. The argument remains to preserve high 'value-add' at the BEP plant and outsource low value-add or waste activities.

Reducing labour hours per engine is the primary cost driver for BEP. This is particularly pertinent given that the total volume of engines is set to increase from 600,000 per annum at present levels, to 1 million predicted for 2010 based on current growth. However, there is no evidence to show that this performance measure would be improved by the introduction of supplier park practices e.g. outsourcing non value-added activity.

Enhanced interaction

There was limited evidence of enhanced interaction due to the co-location of BBB with the exception of a remit to examine existing designs. As part of the BBB contract with

BEP, they must analyse designs in order to deliver on the promise of future savings. *'They have an engineer on site to look at this. They carry out quality checks'* (Supply/Operations). Again, BEP views this as a means to reducing indirect overtime costs, to ship out low value activities to logistics. But this appears to be an implicit threat that the Logistics/MP&L function at BEP would eventually be outsourced. The authors speculate how far this could develop, where the MP&L manager seeks to preserve his personnel and outsource extra volume requirements to a third party logistics provider when overall plant volumes increase. Further, it is not surprising that more general supplier R&D could not be brought into the supplier park as BEP engine development work occurs elsewhere. *'In terms of R&D, the blue oval engines that we produce at Bridgend are linked into our R&D centres in Essex. Jaguar engines are linked with Whitney and Gaydon, and the new 'SI6' will be linked in with Skővde which is based in Sweden'* (Senior Manager). The prospect of attracting design engineering onsite could be an attractive proposition bringing in state-aided high tech jobs into a grant area, rather than current remote locations.

Analysis

A combination of operational, processual and contextual factors conspire against the plans at Bridgend. A key issue for Ford is presenting a strong business case to suppliers for locating on a supplier park. Achieving greater flexibility at BEP is essential and this means being able to attract suppliers willing to late configure components on the park rather than simply adopting a warehousing strategy. At vehicle assembly plants, the business case for doing this is stronger, particularly for the suppliers of interior modules which are frequently bulky and require expensive protective packaging in transport. Outsourced pre-assembled modular components are not currently a significant feature of engine building at Bridgend. But it is the supply of this type of component that is most suitable for a supplier park location and result in the most operational benefits to the firm.

Suppliers of interior modules win contracts relating to a particular model. Model life spans are becoming shorter with frequent redesigns and upgrades, subsequently the contract to supply may be renegotiated more frequently. Having made an investment and

established relationships with logistics companies and the OEM, a presence on a supplier park may put companies in a strong position to win the next contract. However, the life span of an engine type is longer and not vehicle specific. Consequently, without the need to be in a strong position to bid for frequent next model contracts, engine component manufacturers may be less willing to invest in satellite facilities on a supplier park. This may also account for the lack of suppliers volunteering to locate at Bridgend.

In vehicle assembly suitability of suppliers for supplier park location may be determined by the size and transportation cost of the module supplied. To reduce transport and handling costs and ensure delivery performance, the ability of a supplier to locate on a supplier park may be an important part of the OEMs decision to award a contract. The 'hidden' cost of delivery performance should be included in all arguments to locate to the park in order to build the case.

The European Commission (EC) is investigating the cost benefit analysis presented in support of the application by the UK authorities. This contested that the engines for PAG would be built in America if Bridgend did not receive grant aid. Comparing the cost of the two options suggested that Bridgend would have a cost disadvantage of 10% and therefore justified financial aid to keep production in Europe. However, the EC has questioned the comparison which formed the basis of the aid submission, on the basis that all the engines are destined for UK built vehicles and that the two options were not directly comparable. Under the American scheme the engines would be built in America, but the V8 engines would be shared between Bridgend and an additional supplier. If the hidden costs of sourcing parts and engines from the US are included, then the argument may be stronger for Bridgend support.

In the unlikely event of development aid not being awarded to Bridgend, the cost of building an industry park would probably outweigh the operational benefits using current cost estimates. This is especially true if suppliers are not presented with a strong business case that clearly states any advantages available to them as well as Ford. The case for building a supplier park next to an engine plant is difficult to justify without an increase in the use of completed sub-assemblies. The proposed industrial park would mean suppliers late configure, reducing transportation and inventory costs, and allowing them

to add value later in the supply chain. It would also provide Ford with increased flexibility in supply to the plant and provides a higher level of semi-skilled jobs, to the benefit of the local workforce.

Ultimately, events external to Bridgend have strongly contributed to the protracted time span for constructing local infrastructure and progressing core decisions over park design and strategy. BEP managers and the WDA visited the Ford Valencia supplier park in 1999, yet construction in Wales only began in 2003, with the first (and only) supplier arriving onsite in 2005. It is proposed here that the principle causes of this delay were the differences in stakeholder motivation and the general inability to reconcile multiple perspectives. BEP is increasingly concerned over escalating engine volume and variety, and lack of space. WDA's motivation is derived solely from the desire to safeguard the economic future of the region. Ford of Europe continues to focus on the drive to restructure, cut costs and return to profitability. Against the backdrop of more dramatic events unfolding elsewhere in the company (i.e. plant closure), the pressure on Ford senior management to approve expenditure for Bridgend to re-configure its lines of supply must have appeared of relatively low importance.

Conclusion

As firms continue to use best practice as a core ingredient of their strategies it is important that researchers respond with robust theoretical concepts explaining adoption and implementation processes. However, a great deal of the practice debate remains functionally defined and fragmented, and in this respect the paper has sought to integrate disparate perspectives across multiple levels of analysis in order to build a richer and more believable picture of a stalled supplier park initiative. There are clear limitations to this research. In attempting to combine a broad range of theoretical and practical elements, there are detailed associated discussions that could have been more fully explored. Similarly, there are notes on more than 30 hours of interviews and in condensing them into a series of observations and quotes, the researchers own interpretation of events is a significant 'reality' filter. More specifically, by selecting a single case (especially one whose performance appears to diverge from the typical

supplier park phenomenon) raises inevitable concerns over comparability and generalizability of the findings. However, several key conclusions can still be drawn.

First, the notion of practice bundles has proved to be essential in opening up the contingent nature of the building blocks which make up a multi-faceted initiative (Macduffie, 1995; Shah and Ward, 2003). So, while supplier parks can in one sense be considered 'best practice' in a supporting role to Ford vehicle assembly plants, they have also experienced supplier relations issues over component pricing at sites across Europe. The proposed park at Bridgend represents a 'double leap of faith' in terms of it representing a hitherto untested hybrid, an industrial park, based on an adaptation of an original concept whose benefits are consistently contested. At the same time, there is the need to extend the concept to incorporate some of the fundamental network characteristics associated with a collaborative bundle such as the supplier park. Given that the co-ordination of wholly owned and discrete resources such as equipment and inventory is very different from the management of more diffuse resources such as trust and market power, this research suggests that an extended classification of 'practice' based on the extent to which (a) practitioners are able to articulate their relative value (i.e. additive capability less potential rigidities) and (b) realise their direct 'biddability', could add substantially to theoretical and practical development. As an illustration, the case highlights the divergence between avowed strategic plans to build a supplier park and the specific performance measures and measurement systems that have a crucial impact on operational decision-making. Ford's purchasing departments persistent use of piece cost (over other more strategic methods such as total costing) impacted on the supplier park initiative because it informed managerial perspectives on what was achievable at crucial stages during the project. A supplier park can provide much needed volume and variety flexibility, but this was lost to the business because the company was unable to articulate the benefits associated with total costing and what it means for global component sourcing.

Second, the process of implementation was characterised by complexity and political ambiguity. Confusion developed over the primary motivation for adopting the supplier park at Bridgend: the research highlighted both BEP's urgent need to address the increasing space constraints caused by the introduction of PAG engines and the strong

desire by the WDA to gain EC funding for the region. This suggests the supplier park strategy, while supported locally at Bridgend, lacked a champion to support it at the top of the organization. The lack of strategic representation of MP&L and interaction with Purchasing suggests that the WDA and BEP failed to secure the necessary support of senior management and, correspondingly, to convince suppliers of the value of relocation. Moreover, it was difficult to determine the precise effect traumatic events such as UK plant closures and pan-European business re-organization had on the early phases of the supplier park planning and adoption process. Taken as a whole, it is clearly limiting to conceive of change here as a linear transition from one state to another. In the case of BEP it is more a continuous ebb and flow of micro/macro events, shaped by multiple institutional and managerial perspectives. This reflects the trend towards a broadening of Operations Management practice and the increasing interest in areas such as supply strategy (Hayes and Wheelwright, 1984; Fine and Hax, 1985; Dyer, 1996).

Finally, there is clear evidence that the adoption of supplier park practice at Ford and other automaker sites has influenced the thinking of operations managers at BEP. Yet the direct transfer of these practices based on supporting vehicle final assembly leads to a high level of ambiguity over what is the right approach for an engine plant. This type of ambiguity is often followed by isomorphic or bandwagon responses, where firms are faced with high levels of decision-making uncertainty (DiMaggio and Powell, 1991). While the rational arguments of increased pressure on space and flexibility are clearly present in the BEP case, other conditions that have secured supplier park practice at vehicle assembly sites are not, such as influence over supplier location. This reinforces the argument for theory concerning operations and supply practice adoption to consider the wider impact of contextual variables when planning new initiatives, particularly the influence of institutional and strategic choice perspectives.

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Appendix A, Figure A1: Chronology - Ford Motor Company and BEP

1977	Ford announces plans to build an engine plant at Bridgend
1979	First employee starts at Bridgend in September
1980	Bridgend Engine Plant (BEP) opens in May. First 1000 engines – CVH Escort.
1981	BEP engine production reaches 250,000
1983	BEP reaches 1million engines (since opening)
1987	Ford buys AstonMartin
1988	3 million engines (since opening). Zetec engine launch announced.
1989	Ford buys Jaguar
1990	BEP reaches 5 million engines (since opening)
1991	First Zetec engine at BEP
1994	'FORD 2000' initiative - reorganisation of the global business
1995	BEP reaches 7 million engines (since opening). Sigma engine launch
1996	Jaguar AJV8 engine Job 1
1999	Ford announces plans for creation of the Premier Automotive Group Ford buys Volvo Car Corporation BEP managers visit Ford Valencia supplier park with Welsh Development Agency
2000	Decision by Ford to build park at BEP Major restructuring of operations announced at Ford of Europe
2001	BEP wins $425 million of new PAG engine business Ford buys Land Rover
2002	Announcement of transfer of Volvo engine production to BEP Closure of the Dagenham vehicle assembly plant
2003	Park road links and infrastructure in place at Bridgend for industry park Job 1 from new engine line installed for 4.4ltr and V8 New Land Rover Discovery
2004	SI6 engine launch for Volvo
2005	Logistics cross-docking facilities in place at park *First and only supplier 'BBB' located and begins operating from park*

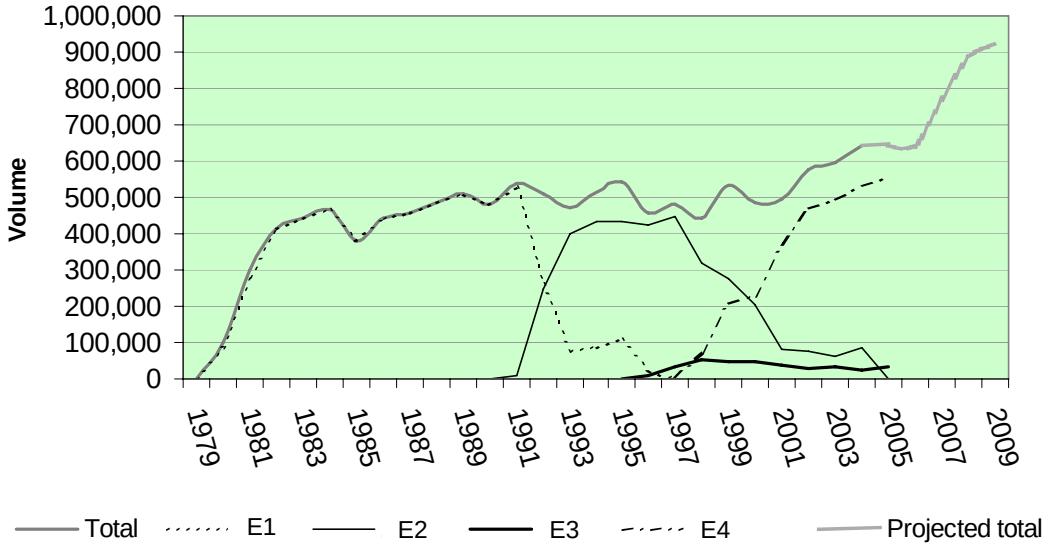

Figure 1: Estimated BEP production volume 1979 – 2009

Strategic choice	Supplier Park Practice	Sources
Supply stability	• Avoiding disturbance • Security & eliminating shrinkage • Bring suppliers physically closer • Creating dedicated non-OEM space • Dedicated infrastructure	Svensson (2000) Chew (2003) Dyer and Singh (1998) Cullen (2002) Miemczyk and Howard (2004) Slack et al (2004)
Supply coordination	• BOM simplification • Supply consolidation/rationalisation • Improved inventory management practices (e.g. VMI) • JIT and JIS supply	Reichhart and Holweg (2005) Cousins (1999) Dyer and Singh (1998) Schonberger (1982)
Value chain re-configuration	• Warehousing, sequencing e.g. SILS • Assembly & late-configuration • Full assembly • Manufacture • Modularisation	Reichhart and Holweg (2005) Dyer and Singh (1998) Larsson (2002) “ Sako (2003)
Enhanced interaction	• More regular meetings & focus groups • Sharing confidential information (Inventory policies) • Cooperation with competitors • Knowledge generation	Larsson (2002), Saxenian (1994) Reichhart and Holweg (2005) Reichhart and Holweg (2005) Saxenian (1994)

Table 1: Practices adopted at European supplier parks

Engine	***Production years*** *(Job 1 – shutdown)*	***Displacement*** *(Litres)*	**Differentiating factors** *(eg Fuelling arrangements)*	***Variety***
'E1'	1979 - 1997 1995 - 1997	1.3 1.4 1.6 1.8 1.4 E	• Derivative introduced in 1995	 5
'E2' Petrol 4 cylinder	1991 - 2004	1.4 1.6 1.8 2.0		 4
'E3' Petrol V8	1996 -	3.5 4.2	• Supercharged & naturally aspirated • 3 models	 6
'E4' Petrol 4 cylinder	1998 -	1.25 1.4 1.6	• Variable cam timing (VCT) & non-VCT • 2 vehicle applications • Manual & automatic	 9
'E5' Petrol V8	2004 -	4.2 4.4	• 2 fuelling arrangements • 2 models	 4
'E6' Petrol I6	c. 2006 -	3.2 3.0	• 3.0 Litre supercharged • 3 models • Models within brands	 24
'E7' Petrol V8 (upgrade)	c. 2008 -	3.5 4.2 4.3 4.4	• 4.2 Litre supercharged	 7

Table 2: BEP product variety 1979 – 2009

No.	*Date*	*Interviewee/s*	*Scope*
1	20 October **2001**	Development Manager Project Manager	WDA plans for the development of the Welsh automotive sector
2	14 February **2002**	MP&L Manager	Initial site visit and familiarisation with BEP
3	6 March	Global Order Fulfilment Director	Ford global supply strategy Detroit, US
4	12 April	Program Manager	Site visit to Delphi, PAG supplier park, Sweden.
5	16 April	Production Manager Client Executive	Site visit to Delphi, Ellesmere Port
6	18 July **2003**	MP&L Manager Development Manager	Site visit to proposed BEP park
7	21 July	Project Manager	Q&A session: supply chain complexity at BEP
8	28 November	MP&L Manager Project Manager	Engine-block supply using CMMS v eSMART at BEP
9	14 January **2004**	Plant Manager	Analysis of BEP production plant
10	25 February	MP&L Manager Rail Manager	Analysis of BEP railway link and eSMART IT system
11	2 June	Plant Manager	BEP supply chain mapping session
12	21 June	MP&L Manager	Initial research findings to BEP
13	30 July	MP&L Manager Plant Manager	Presentation and feedback with BEP managers
14	22 November	Supply Manager	Site visit to SiemensVDO to discuss supplier scheduling
15	19 January **2005**	Logistics Manager Logistics Engineer	Site visit to Ford supplier park in Cologne, Germany
16	25 February	MP&L Manager	Meeting to review current progress with park
17	22 March	Development Manager	Discussion over WDA regional aid for BEP
18	11-12 May	MP&L Vice-President MP&L Manager	Meeting with PAG member Volvo to discuss SP strategy
19	9 -10 November	MP&L Manager	Meeting with Volvo to discuss global sourcing strategy
20	19 December	MP&L Manager	Meeting to review situation with BEP and Ford Europe strategy

Table 3: Supply practice research

Strategic Intent	Supplier Park Practice	Present at Bridgend
Supply stability	• Avoiding disturbance • Security & minimising shrinkage • Bring supplier physically closer • Creating dedicated non-OEM space • Dedicated infrastructure	- - * One supplier BBB * Single warehouse -
Supply coordination	• BOM simplification • Supply consolidation/rationalisation • Improved inventory management practices (e.g. VMI) • JIT and JIS supply	- * Rationalised 32 to 1 * Complexity to supplier * JIT to BEP
Value chain re-configuration	• Warehousing • Sequencing e.g. SILS • Assembly & late-configuration • Full assembly • Manufacture • Modularisation	***** Dedicated warehouse - - - - -
Enhanced interaction	• More regular meetings/focus groups • Sharing confidential information (Inventory policies) • Cooperation with competitors • Knowledge generation	- - ***** Discuss design changes -

Table 4: Practices adopted at BEP