

**THE IMPACT OF INCLUSIVE AND FRAGMENTED
OPERATIONS STRATEGY PROCESSES ON
OPERATIONAL PERFORMANCE**

**Professor Steve Brown
University of Exeter
Dr. Brian Squire
Manchester Business School
Professor Mike Lewis
University of Bath**

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Abstract

The links between strategy and performance remains an elusive “holy grail” for researchers and practitioners alike. We do not seek to provide a prescriptive panacea in this paper but we find links between particular types of strategic formulation and operations performance in a range of key parameters. Our research focuses on the PC industry where there are high demands placed on the capabilities of the operations function. We suggest that such capabilities do not happen by accident but are developed by specific strategies whereby in-house operations and business mainstream strategies, including supply, become closely linked in both planning and implementation.

THE IMPACT OF INCLUSIVE AND FRAGMENTED OPERATIONS STRATEGY PROCESSES ON OPERATIONAL PERFORMANCE.

Introduction

This paper examines the relationship between strategic formulation, strategic implementation and performance in a range of operations parameters. Further, the paper examines the explicit links between business mainstream and operations strategies within firms by exploring the strategy formulation process and possible links between this relationship and subsequent operations performance. Finding links between strategy formulation and ‘success’ remains one of the ‘holy grails’ (Golden and Powell 2000, Kaplan and Norton 2004) within the strategy literature. We do not seek to provide a panacea but believe that this paper will provoke interest and potential for further research on the links between strategic operations planning and performance.

Clearly, to assume that there will be a linear relationship between strategy formulation and consequent success is suspect (Mintzberg et al 2000). However, to assume also that a set of dynamic capabilities (Teece et al 1997) will be in place purely ‘by chance’ both within the firm and with partners within complex networks is also a problematic proposition (Brown and Blackmon 2005). This paper does not pretend to provide specific links between generic strategy formulation and subsequent performance but does purport to find links between *particular types* of strategic formulation and performance. We will discuss the emergence of two groups, one of which we call *strategically inclusive*; the other we term, *strategically fragmented*. As we shall see, we then explore links between these two types of strategic groups and subsequent performance in a range of operations parameters, notably inventory management, including how firms manage relationships with their suppliers within the supply chain.

This paper is constructed as follows. In the next section we discuss some of the key issues within the literature related to operations strategy. Next, we examine specific links between operations strategy and strategy mainstream literature and explore some of the inherent weaknesses in the two, interlinking bodies of literature. We then provide a brief overview of the PC industry and discuss the dependence upon the operations capabilities of firms competing within the PC industry. The subsequent section describes our primary research, including methodology and findings; we then conclude, list the limitations of the research, and suggest possibilities for future research as well as implications for managers from our findings.

Operations Strategy.

Manufacturing/operations strategy can contribute substantially not only to operations management but also to business strategy (Anderson et al. 1991; Meredith & Vineyard 1993), influencing areas as diverse as:

1. The selection of new process technologies (Honeycutt et al. 1993; Schroeder et al. 1995; Wathen 1995; Gagnon 1999; Beach et al. 2000). It has been noted that a key element of accruing capabilities in flexibility comes from the utilisation of process technology where, again, the role of manufacturing/operations strategy can be pivotal (Kathuria and Partovi 2000).
2. New product development (Voss et al. 1996; Spring & Dalrymple 2000).
3. Human resource management (Bates et al. 1995; Youndt et al. 1996).

Tunälv (1992) found that firms with a formulated operations strategy achieve higher business performance than firms without such a strategy, with respect to Return on Sales. Papke-Shields and Malhotra (2001) extended this research by explicitly testing the alignment between business and manufacturing strategies and firm performance. Sun and Hong (2002) examined the relationships between alignment, business performance and manufacturing performance. They found that alignment has a positive, although not linear, relationship with four subjective measure of business performance. Joshi et al (2003) provided interesting insights into strategic alignment within the firm and Manufacturing/Operations performance.

It is nearly forty years since Skinner's (1969) seminal contribution to the literature on manufacturing/operations strategy and although operations strategy research has matured (e.g. Swink and Way 1995, Vickery et al. 1993, Verma and Goodale 1995) it remains, typically, conceptually subservient to the broader strategy field (Akkermans and Von Aken 1992, Brown 2000, Brown and Blackmon 2005).

The importance of the operations function on a strategic level – specifically manufacturing operations – can be traced back to Skinner (1969). This was the first time that the competitive potential of the operations capabilities of the firm - and the attendant need to link these to the firm's strategic decision levels - was first explored. Skinner (1974) developed some of his thinking with the concept of the focused factory, again linked to how the firm could compete via its in-house capabilities. Further major insights were forthcoming throughout the 1980s from both the USA and UK (for example Hayes and Wheelwright 1984, Hill 1985). Often, manufacturing operations literature was couched within manufacturing paradigms and a summary of how the firm's operations were linked to specific modern

manufacturing terms was provided by Brown and Cousins (1994:306) shown here in Figure 1:

Please insert figure 1 about here

However, as important as Skinner's and other contributions have been, there are problems with their application to the current competitive arena. First, the focus on firm-specific capabilities now needs to be broadened into discussions on capabilities outside the domain of one firm and needs to be seen instead within more complex networks or supply chains. This is highly relevant to the primary research of this paper, which is the assembly of Personal Computers where strategy is not merely a firm specific process but must also be seen as an inter-firm engagement within sets of organizations. Thus, firm-specific capabilities, although very important, also need to be seen within a wider context of sets of capabilities that reside within what are, often, complex networks (Kouvelis et al 2006; Boyer et al 2005; 2006; Buhman et al 2005; Holcomb and Hitt 2007; Rudberg and West 2008).

Second, operations strategy has often been written as an entity within itself, aside of the strategy/business mainstream. Consequently, its impact has been questioned (Brown and Blackmon 2005). This is not intended to be a pejorative assertion; indeed the opposite is true with this paper, which is motivated by an observed lack of alignment between operations strategy and mainstream strategy research. After all, even if one questions traditional hierarchies where the strategic role of operations is limited to supporting corporate and market(ing) decisions, it is self-evident that operations strategy concepts must at least be cognizant of mainstream strategic management concerns (Wheelwright and Clark 1992).

There are areas where the connections are impressive. Consider how, for instance, operations strategy research contrasting 'outside → in' (Hill 1985, Platts and Gregory 1990) and 'inside → out' models (Hayes 1985, Cleveland et al. 1989, Vickery 1991, Dröge et al. 1994, Mills et al. 2005) echoes and develops debates about market-led¹ or resource-based² views on strategic fit (Miles and Snow 1984, Hosskisson et al. 1999, Johnson and Scholes 2003). At the same time, however, significant disconnects persist - in particular in the area of

¹ Posits competitive changes within markets should determine market strategy - including entry and exit decisions (Haspeslagh 1982; Hax and Majluf 1983, 1988, 1991, Boeker *et al.* 1997). Typified by the Structure-Conduct-Performance (SCP) paradigm (Porter 1980, 1985, Thomas and Pollock 1999).

² Posits advantages sustainable because of strategic resources (Rumelt, 1984, Barney 1986, 1991, Mahoney and Pandian 1992) that are scarce, imperfectly mobile and imperfectly imitable.

strategy processes - and we will argue in this paper that these conceptual gaps are detrimental to the development of the operations strategy sub-field. The last decade has seen strategy become much more interested in 'strategy as practice' (e.g. Barry and Elmes 1997, Oakes et al. 1998, Hendry 2000, Whittington 1996, 2001) in part because of evidence that, faced with global competitive pressures, alternative rents can be generated by leveraging micro-assets enabled, to a large degree, by the strategising process itself (Johnson and Scholes 2003).

Corresponding interest in the 'practice of operation strategy,' however, remains minimal (Anderson et al. 1989, Minor et al. 1994, Dangayach and Deshmukh 2001, Barnes 2001, 2002). This is despite the POM field's avowedly practitioner-centric nature and research suggesting firms with formulated operations (manufacturing) strategies achieve higher business performance (Return on Sales) than firms without (Tunälv 1992) and a positive performance impact associated with alignment between business and manufacturing strategies (Papke-Shields and Malhotra 2001, Sun and Hong 2002, Joshi et al. 2003). Given this context, the decision was taken to focus our research on the pivotal question of whether there is any demonstrable relationship between the nature of the operations strategy process and operational performance. In doing so, the aim was to provide a clear motivation for subsequent research (i.e. 'we should worry about process because it impacts performance!').

Using questionnaire and interview data from a study of the Personal Computer industry, preliminary evidence of differential operational performance (e.g. defect and inventory levels, speed of NPI, etc.) associated with what are classified as either 'inclusive' or 'fragmented' operations strategy processes can be highlighted.

Conceptual Background

Interestingly, just as mainstream strategy's interest in the 'practice turn' is in part a pragmatic return to practitioner priorities (i.e. 'how to do strategy') and in part a reflection of how hyper competitive global markets have reduced returns to traditional macro assets (e.g. returns to scale, barriers to entry), operations strategy faces much the same set of issues. Although much academic research focuses on 'live' managerial preoccupations, significant voices within the discipline regularly express concern over its level of impact on practice (Voss 1995). Operations strategy practitioners are faced with the challenge of immediacy and process is therefore particularly important because relevant "operating decisions are made thousands of times per day by virtually every individual in the organization" (Boyer and McDermott 1999: 290). Without an understanding of the strategy process, short-term decisions can often conflict with long-term capability-building goals (St John and Young

1992). This notion of asynchronous operations strategy development becomes ever more challenging as rapidly escalating competition demands increasing efficiency, flexibility, delivery speed, and innovation (Brown 1996, 2000, Spring and Dalrymple 2000, Kathuria and Partovi 2000). It is surprising therefore, that although there is an operations strategy process literature³, the subject remains a minority concern. As an illustration, Dangayach and Deshmukh (2001) classified only 23 out of the 260 (9%) manufacturing strategy papers in their literature review as having the process of strategy as their subject. Moreover, as Barnes (2002) has noted:

“the most important ... process writers have followed Skinner’s prescriptive intent, primarily focusing on how managers should ensure that an effective ... strategy is formulated rather than how it might be formed in practice” (2002: 1091).

Such prescriptive operations strategy processes are perhaps best illustrated by considering the seminal Hill (1985) five-stage framework. Step one involves understanding the long-term corporate objectives of the organization so that the eventual operations strategy can be seen in terms of its contribution to these corporate objectives. Step two involves understanding how the marketing strategy of the organization has been developed to achieve corporate objectives. This step, in effect, identifies the products/service markets the operations strategy must satisfy, as well as identifying the product or service characteristics such as range, mix and volume, the operation will be required to provide. Step three translates marketing strategy into the factors that are important to the operation in terms of winning business or satisfying customers. Step four is ‘process choice’ where decisions are made about the coherence of the operations structural characteristics. Step five involves a similar process but this time with the infrastructural characteristics. Although sometimes characterized as such, the framework is not intended to imply a simple sequential movement from step one to step five, although during the prescribed formulation process the emphasis does move in this direction. Rather, the process is presented as an iterative one, whereby managers cycle between an understanding of the long-term strategic requirements of the operation and the specific resource developments that are required to support strategy. In this iterative process the identification of competitive factors in step three is seen as critical. It is at this stage where any mismatches between what the organization’s strategy requires and what its operation can provide, become evident.

³ Key contributions including Skinner (1969), Hill (1985), Platts and Gregory (1990), Mills et al. (1995), Menda and Dilts (1997), Brown (1998), Barnes (2001, 2002). etc.

The steps in the Hill (1985, 1995) framework are closely related to classic corporate planning methodologies (with clear separations of responsibility, strong functional tasks etc.) but Hill (*ibid*) argues that whereas the first three elements are treated as interactive and iterative, the final two are commonly presented as straightforward, linear, logical implementation issues.

Research has highlighted the need for consistency among decisions that affect business-level strategy, competitive priorities and manufacturing strategy and infrastructure (e.g. Skinner 1969; Hayes & Wheelwright 1984; Fine & Hax 1985; Schroeder et al. 1986; Hill 1985; 1995), as well as highlighting the manufacturing performance benefits of cross-functional (e.g. marketing-manufacturing) congruence and consensus (Bozarth and Edwards 1997, Boyer and McDermott 1999). Conceptually and empirically however, there has been very little research (Barnes 2002) focused less on the study of discrete organisational ingredients and more on contextually situated strategy behaviours (Pettigrew 1992).

From the above discussion it became apparent that there are gaps in the literature including the specific links between strategy mainstream and operations strategy; and the links between these two entities and performance at plant level. It is these areas that we shall examine in the primary research. First, we shall look briefly at the PC industry, which forms the context of our primary research.

The PC Industry

The PC Industry had shipments of nearly 55 million units in 2006 (Datamonitor 2006). In addition to high volumes, the task for manufacturers and assemblers is to provide speedy response and, often, customized offerings to customers. Thus, there are huge demands placed upon operations capabilities and such capabilities do not come about by chance but are developed and accumulated over time aided by operations strategies (Brown and Bessant 2003).

The change from firm-specific operations to a network of capabilities, to which we referred earlier, is clearly evident within the Personal Computer Industry. In the past, the Computer Industry had corporations such as IBM, NCR, DEC, NEC and Wang that competed against each other as huge, vertically integrated enterprises. Each produced its own chips and system software based, essentially, on its own specific system. IBM and DEC in the USA were among the most vertically integrated, capable of making almost every part of their products. This vertically integrated organizational structure was the context within which the seminal work of Skinner (1969) and Hayes and Wheelwright (1984) appeared. These authors,

and others, made convincing cases for the operations function to be seen at strategic levels within the hierarchy of the firm. This vertical integration strategy with its attendant rigid hierarchical structure may have been appropriate for some time under mass production but by the early 1990s large players who were vertically integrated, including IBM and DEC, had become consistently the worst performers in the Computer Industry. By the late 1990s, outsourcing became a major strategic issue for firms in the PC Industry where firms were increasingly tied into an external network organizational form. Former, in-house activities were now outsourced to suppliers (Quinn, 2000), and the Personal Computer Industry, along with many others was notable for a plethora of strategic alliances dependent on the creation of an external network of partners (Saxenian, 1991; De Vet and Scott, 1992; Bartholomew, 1997; Baptista and Swann, 1998).

Plants within the PC industry must be fast, agile and responsive to react quickly to changes in customer demand and to do so with little inventory. Thus, inventory becomes a key operations parameter within the industry, not only on a plant-specific level but also in the relationships between firms and their suppliers. Consequently, these key aspects of inventory form a central feature of our primary research. In the past, under mass production where slow delivery times were the norm and little customization was required, manufacturers could stockpile large quantities of raw materials, work-in-process and then pack warehouses with finished goods. The old ways led to long lead times, high costs and required vast amounts of working capital. Clearly, these issues have impact for both operations and mainstream strategies. It is axiomatic that money tied up in inventory could be better spent on a range of business issues including new product development, business growth, investing in processes and plants. Poor inventory management is a clear indicator of more serious and costly business process and systems problems that can impact very deeply across a range of operations capabilities, including quality and innovation. These are factors under scrutiny in our primary research.

Primary research

Our research explored the relationship between the content and process of manufacturing/operations strategy (including elements of supply), and performance. Whereas a number of previous studies have used perceptual measures of performance (e.g. Papke-Shields and Malhotra, 2001; Sun and Hong, 2002; Joshi et al, 2003), this study is based on objective measures. It is accepted that perceptual measures may be used when objective measures are not relevant or available (Dess and Robinson, 1984). However, the firms in our

sample were both willing and able to share objective measures, with the caveat that confidentiality needed to be maintained.

Business performance is primarily measured at two levels: the domain of financial performance or the domain of operational performance (Venkatraman and Ramanujam, 1986). It was considered that the domain of operational performance was more appropriate given that the study examined business unit level strategy. This may help fill a further gap in the literature because: "...when alignment [between manufacturing and business strategy] has been studied, its impact on the manufacturing unit's performance has rarely been examined" (Joshi et al, 2003, p355).

Given the difficulties in obtaining objective data at the level of the manufacturing/operations unit (Avella et al, 2001), we used a combination of a vast literature survey on topics of business strategy and operations strategy coupled with academic literature that focused on plant parameters (for example: Womack et al, 1990; Oliver et al, 1996, Brown et al 2007). As a result of this we examined operations performance in terms of four factors: quality, inventory, supplier management, and innovation. This leads us to the following four hypotheses:

H1: The involvement of operations in the strategy process has a positive effect on quality.

H2a: The involvement of operations in the strategy process has a negative effect on inventory levels.

H2b: The involvement of operations in the strategy process has a positive effect on inventory turns.

H3: The involvement of operations in the strategy process has a positive effect on supplier relationships.

H4: The involvement of operations in the strategy process has a negative effect on new product development time.

Research Methods

Sample and data collection

The investigation focused on a sample of 15 plants in a single product-market sector, Personal Computers, in order to minimize the influence of contextual variables. The study began with 17 plants but two of these closed their UK and USA operations in order to transfer assembly to Korea and China. All 15 plants maintained an in-house manufacturing and/or assembly capability. We examined three plants in the USA; seven within Europe; one in

Singapore; two in Malaysia and two in Taiwan. All but 2 of the plants (one in Europe and one in the US) were operating units under the leadership of a separate headquarters function.

The survey instrument was administered to senior-level managers whose positions within the hierarchy of the firms were consistent across the plants. In each case we interviewed the most senior level contact available within the specific function, typically respondents such as manufacturing directors, finance directors or the Chief Operating Officer. The range of respondents varied from three to six per plant and the typical (median) length of the interviews was 60 minutes. In addition, we had access to operations data that we utilised as long as we agreed not to name the companies' plants.

Measures

In exploring the strategy process – i.e. how plants devised strategies - and in particular examining the specific role of operations personnel, ten items were used to determine the extent to which operations managers respondents were integrated into the strategy process and involved in content decision making. We used a Likert single item scale (1 = Strongly disagree to 5 = Strongly agree) to measure agreement with four process-based statements and six content-based statements. With the aim of developing previous research in operations performance in the PC industry (e.g. Brown and Cousins 2004, Brown et al 2007) we asked the following four questions related to the ***process of strategy***:

To what extent do you agree with the following statements for your plant?

1. Senior operations personnel are actively involved in the business strategy process and not employed purely as plant technical specialists.
2. There are explicit, plant-specific, operations strategies in place.
3. These strategies feed into, and form part of, business strategy.
4. There is cohesion in content and timing between business and manufacturing strategies.

We asked the following six questions related to the ***content of strategy***:

To what extent are manufacturing personnel at your plant actively involved in the decision-making process for the following:

1. The nature and shape of the supply chain – involving the degree of vertical integration as well as buyer-supplier relations for the plant.
2. Process technology issues – including the degree of, and rationale behind, investment in new process technology for plants.
3. Medium/long-term capacity decisions – including involvement in decisions on adding to, or downsizing, or even divesting entire plants.

4. Short-term capacity decisions – including determining levels of production of existing products and models of the plant’s current product portfolio.
5. Other infrastructure initiatives - including new facilities/location decisions.
6. New product development in both existing and new markets.

A combination of extant measures from the academic literature (for example: Womack et al, 1990; Oliver et al, 1996) and those made available by the firms were used in assessing plant performance across the following nine items:

1. Percentage of failure at final inspection
2. Percentage of operations employees involved in QCs or CI activities
3. Annual number of suggestions per employee
4. Class A inventory WIP levels (hours)
5. Finished goods inventory (hours)
6. Inventory turns (yearly)
7. Percentage of class A suppliers having contracts lasting more than 3 years
8. Number of suppliers accounting for over 80% of purchases
9. Innovation time of new product development (NPD) (months)

Results

The data set was analysed in two stages. The first stage clustered the 15 plants according to both the process of strategy development and the content of strategy, with the analysis based on the ten questions listed above. The second stage analysed the performance of the emergent clusters.

Cluster analysis

A two-step cluster analysis was used to group the firms. The first step was a hierarchical agglomerative technique (Ward’s minimum variance cluster method), used to distinguish outliers and to determine an appropriate number of clusters to be carried forward to step two. We used hierarchical cluster analysis followed by an independent samples t-test (see below) to analyse the data due to relatively small sample size. Both these techniques are suitable for sample sizes equivalent to ours (e.g. Brown and Melamed, 1993; Hair et al, 1998). Using the agglomeration schedule it was noted that no single member clusters were present, therefore it was assumed no outliers existed. We recognise that determining the number of clusters can be somewhat subjective and in response, we adopted the procedure suggested by Hair et al (1998). The number of clusters was selected using changes in the

agglomeration coefficient. Small coefficients indicate fairly homogenous clusters, whereas, large coefficients or a large percentage change in the coefficient indicates heterogeneous clusters. The agglomeration coefficient shows a large percentage increase in going from two clusters to a single cluster (627%). This may be contrasted with the much smaller percentage changes in going from three to two clusters (27%) and four to three clusters (26%).

Step two consisted of an iterative partitioning (SPSS Quick Cluster) cluster analysis. The cluster centroids from the hierarchical analysis were used as initial seed points for the final clusters. The cluster centres were slightly adjusted when compared to step one, however no change was observed in the group members. Table 1 shows the final cluster centres for the two groups. Examination of the two clusters shows that cluster two has higher values for all of the associated variables. Furthermore, it appears that all variables were highly significant in distinguishing the two clusters.

[Please insert table 1 about here]

To check the stability of the cluster solution we applied an alternative method and compared the results (Hair et al, 1998). A second non-hierarchical analysis was performed allowing SPSS to randomly select the initial seed points. The results were comparable between the techniques validating the solution shown in table 1.

To check the predictive validity of the final solution we focused on a variable that has a theoretically based relationship to the ten clustering variables, but was not included in the cluster solution. We asked whether operations personnel were in place at senior management levels of the firm. It would appear this variable is closely related to the original ten variables, but could not be included in the cluster analysis because ordinal variables are not supported by distance measures (here we used squared Euclidean distance). If a significant difference exists for this variable we can conclude that the two clusters display predictive validity. We conducted an independent samples t-test on the two clusters. The test indicated that the cluster means are significantly different (see table 2), showing that cluster two was significantly more likely to have manufacturing personnel in place at senior management levels than cluster one. This further validates the solution shown in table 1.

[Please insert table 2 about here]

Interpretation of clusters

Two clusters were identified with evidence of both stability and predictive validity. The interpretation stage involves assigning each cluster a name or label that accurately describes the nature of that cluster (Hair et al, 1998).

The first group of plants (cluster 1), those expressing themselves as unconcerned with the process of formulating either business or manufacturing strategy, are termed *strategically fragmented*. We used this term because these plants' characteristics clearly represent the chief concerns from Skinner (1969) to the present day within the operations strategy literature. The main concerns include the absence of operations personnel at strategic levels of the firm together with lack of involvement in the strategic direction of the firm and the consequent lack of operations strategies that link with wider, business-level strategies.

This cluster represents six plants or 40% of the sampled population. Plants with *strategically fragmented* strategy processes display low scores on all variables (cluster means between 1.14 and 2.43, on a five point Likert scale).

The second group of plants (cluster 2), those appearing concerned with the process of formulating both business and/or manufacturing strategy, are termed *strategically inclusive*. This cluster represents nine plants or 60% of the sampled population. Plants display high scores on all variables (cluster means between 4.56 and 5.00, on a five point Likert scale). Specifically, operations personnel are more likely to be involved in the business strategy planning process and key business level decision-making processes. Furthermore, plants are likely to have explicit manufacturing strategies, which feed into, and form part of, business strategy.

Linking strategy process and operations performance

The third stage was to examine the degree to which there were relationships between strategy formulation, based on the clustering of the two groups, and performance. We emphasise here that stages 1 and 2 were decoupled and we ensured that we did not contaminate data. In order to test the hypotheses a comparison of means of the *strategically inclusive* and *strategically fragmented* plants was conducted using an independent samples t-test. The results are shown in table 3. Table 3 shows highly significant results for all seven variables ($p < 0.001$).

Discussion

We found that *strategically inclusive* plants display a different attitude to quality issues to the *strategically fragmented* plants, fully supporting hypothesis 1. Although neither group was able to demonstrate quality capabilities of “zero defects”, *strategically inclusive* plants significantly outperform their *strategically fragmented* rivals. The two groups differed significantly in terms of the number of employees in QCs and CI activities, the annual number of suggestions per employee and the percentage of failure at final inspection.

Although it is not possible to draw a direct line of causation it is proposed that involvement in QCs and CI activities and number of employee suggestions *may* contribute to a lower percentage failure at final inspection. Of interest, is that all *strategically inclusive* plants remain committed to TQM; *strategically fragmented* plants had either not been involved at all or had abandoned TQM in the past. What became substituted in its place are a number of hybrid approaches together with various in-house cost-cutting initiatives, not necessarily related to quality.

In support of hypotheses 2, we found that *strategically inclusive* plants carry less inventory than *strategically fragmented* plants and have higher inventory turns. *Strategically inclusive* plants differ significantly from *strategically fragmented* plants in terms of both WIP and finished goods inventories. The contrast between *strategically inclusive* and *strategically fragmented* plants was telling: the range of “Class A” components' work-in process for *strategically inclusive* plants was 2-14 hours; by contrast, in the *strategically fragmented* plants, this ranged from 24-42 hours. Finished goods inventory ranged between 2-12 hours for *strategically inclusive* plants; it was between 24 and 36 for the *strategically fragmented* plants. Moreover, annual inventory turns ranged from 40-105 in *strategically inclusive* plants compared to only 10-22 turns in *strategically fragmented* plants.

In support of hypothesis 3, we found that *strategically inclusive* plants have a larger percentage of suppliers with long-term contracts than *strategically fragmented* plants. On average 90% of the Class A suppliers of *strategically inclusive* plants enjoy contracts of longer than 3 years, compared to just 30% of *strategically fragmented* plant suppliers. Perhaps the most interesting data came from the rationale in selecting suppliers; in *strategically fragmented* plants, price always scored the highest; price was the lowest factor in the *strategically inclusive* plants, whose primary reason for choosing suppliers was quality, followed by a number of different priorities after quality. *Strategically inclusive* plants were also more likely to have a consolidated supply base, with between 78-110 suppliers accounting for 80% of purchases compared to between 118-152 suppliers in *strategically*

fragmented plants. Again, supply base consolidation is seen as an important precursor to collaborative forms of supplier relationship and supplier relationship performance (Squire et al, 2006).

As predicted, *strategically inclusive* plants display faster rates of new product development than traditional plants thus supporting hypothesis 4. *Strategically inclusive* plants differ significantly from *strategically fragmented* plants in terms of innovation time of new product development. On average new product development time is approximately a third less in *strategically inclusive* plants.

Conclusions, Limitations, and Future Research Directions.

Before highlighting the key conclusions derived from the analysis of the research, it is important to reflect upon the work's limitations. Our study has several limitations. First, the relatively small sample size is one factor that is immediately obvious. Although our statistical methods are appropriate to test the hypotheses that we have proposed here, the statistics are sensitive to sample size. Thus, a larger sample size would be desirable to obtain more stable findings and so this provides opportunities for further research.

Second, the focus on only one industry has clear advantages but it inevitably raises questions of generalizability and transferability. Future research could take a multiple-source data collection approach in order to deal with this issue.

Third, this was an exploratory study and although well-established metrics were used, we only explored four operations performance parameters (quality, inventory, supplier management and innovation). Future research could examine a range of other important operations performance measures including flexibility, delivery, cost, customisation or variety. Some of the measures used to examine the four capabilities could be expanded. In particular, supplier management measures could examine in more depth the nature of the relationships as well as their duration.

Fourth, we have described what has happened – namely, that there appears to be links between the process of strategy and subsequent performance. What we have not done is to analyse in depth *why* such links exist and, again, this provides opportunities for future research where more in-depth, firm-specific, profiling could be undertaken via further longitudinal case studies.

Whilst we accept that our study has limitations, it has also exhibited some interesting and important findings, namely that the process and content of operations strategy tends to have an impact on operations performance in a range of key parameters. There can be no doubt that the current competitive arena, which includes Lean Production, Mass customisation and Agile Manufacturing, places huge demands upon operations capabilities and integral to accruing and developing such capabilities are two ingredients that form the core of an inclusive strategy formulation process: the role of senior-level operations personnel and the nature and scope of the manufacturing/operations strategy, which has to be explicitly linked to the business strategy of the firm. Specifically, in spite of the changes to manufacturing practices, we suggest that the process of formulating and implementing strategy has not kept pace with such changes over time. A more detailed focus on the formulation process thus makes an important contribution to the strategy process within volatile competitive conditions.

As we have noted, all of the *strategically inclusive* plants had senior manufacturing/operations personnel⁴ in place, yet three of the fragmented plants also had senior manufacturing/operations personnel. Thus, the mere presence of senior-level operations personnel within the hierarchy of the firm does not by itself, explain the differences behind the role and contribution that operations personnel might have within a plant. However, the distinction between *strategically inclusive* and fragmented plants lies in the importance of the manufacturing/operations strategy. In the *strategically inclusive* plants manufacturing/operations strategy was explicitly linked to the business plan, and addressed broader business concerns such as the degree of vertical integration, sourcing and developing supplier relationships, new product development, and involvement in selecting partners in alliances. In the *strategically fragmented* plants, operations strategy either did not exist at all or, if it did, it was focused on technical solutions around processes.

The paper thus offers implications for both academic researchers and practitioners alike. We have outlined some of the opportunities for researchers above and in particular we stress the need for better cohesion and dialogue between operations strategy and business mainstream literature. Although the two bodies of literature are not mutually exclusive, at present the links between the two and the co-dependence of each in a range of overlapping areas need to be explored in depth.

⁴ The actual title of the most senior-level manufacturing/operations manager provides limited insight into the role that a person may have. For example, we found instances of vice presidents of manufacturing/operations who seemed to spend little or no time in plants and consequently any links between business strategy and manufacturing/operations strategy were very limited.

For practitioners, particularly within industries that seek to outsource operations activities in the name of cost reductions, there are major implications. The key issue is that senior level personnel need to ensure that there are specific operations and business strategies in place and that the capabilities of the firm are accumulated, developed and safeguarded over time.

Tables and Figures:

Figure 1: Operations Strategy and the links to manufacturing paradigms

Paradigm	Author	Description
Mass Customisation	Pine <i>et al</i> (1993)	Reflecting the need for high volume combined with recognition of customers' (or 'consumers') specific wishes
Flexible Specialisation	Piore and Sable (1984)	This concept relates to the manufacturing strategy of firms (especially small firms) to focus on parts of the value-adding process and collaboration within networks to produce whole products.
Lean Production & Lean Supply	Womack <i>et al</i> (1990); Lamming (1993)	This concept was developed from the massively successful Toyota Production System (TPS), which focused on the removal of all forms of waste from the production transformation system.
Agile Manufacturing	Kidd (1994)	This concept emphasises the need for an organisation to be able to switch frequently from one market-driven objective to another.
Strategic Manufacturing	Hill (1995); Brown (1996; 2000)	Here the authors emphasise the need for the Operations capabilities to be framed in a strategic context and brought to the fore. The authors offer templates to positioning Operations capability and strategy.

Table 1: Two cluster solution of non-hierarchical cluster analysis

Factor	Cluster 1 (n=6)		Cluster 2 (n = 9)		F
	Mean	SD	Mean	SD	
Active involvement in strategy	1.71	.49	4.56	1.01	46.112***
Explicit, plant level strategies	1.86	.38	4.78	.44	194.895***
Integration into business strategy	1.14	.38	4.67	.50	239.575***
Cohesion in content & timing	1.86	.69	4.56	.53	79.023***
Active involvement in supply chain	2.43	.53	4.89	.33	128.182***
Active involvement in technology investment	1.86	.38	4.56	.53	130.348***
Active involvement in capacity decisions	2.00	.58	4.67	.50	98.000***
Active involvement in production levels	2.14	1.22	4.56	.53	28.963***
Active involvement in growth initiatives	2.14	1.07	5.00	.00	65.625***
Active involvement in NPD	2.29	1.11	4.67	.50	33.144***

*** Significant at $p < 0.001$

Table 2: predictive validity of final solution (equal variances assumed)

Factor	Cluster 1 (n = 6)		Cluster 2 (n = 9)		<i>t</i>
	Mean	SD	Mean	SD	
Senior ops personnel	1.11	.33	1.86	.38	-4.192***

*** Significant at $p < 0.001$

Table 3: Operations performance of *strategically inclusive* and *dissonant* clusters

Factor	<i>Strategically fragmented</i> (Cluster 1) n = 6		<i>Strategically inclusive</i> (Cluster 2) n = 9		<i>t</i>
	Mean	SD	Mean	SD	
% of failure	4.90	.69	1.35	.26	-12.889***
Involvement in QC & CI	12.86	17.04	84.44	9.50	9.973***
Suggestions per employee	8.43	2.23	21.89	3.22	9.418***
Class A inventory WIP	33.71	5.94	8.56	5.08	-9.140***
Finished goods inventory	28.29	5.71	7.00	3.97	-8.815***
Inventory turns	15.66	4.97	59.44	19.60	5.30***
Long term suppliers	30.00	14.14	90.00	6.61	10.377***
Number of suppliers	130.67	12.37	94.22	12.41	-5.58***
Innovation time of NPD	34.86	4.60	21.78	3.38	-6.571***

*** Significant at $p < 0.001$

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