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Reinterpreting Fisher's coordinated strategies: a longitudinal case study

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Abstract

Purpose – Much has been written about the need to align the supply chain with the product/market but it has proved, elusive especially in response to a supply change transitions. This paper reviews the established theoretical models before considering how the realignment process can be better supported in the light of a longitudinal study.

Design/methodology/approach – This paper uses a single apparel case where data was gathered over a five-year period involving multiple site visits, management interviews and archival data across three echelons of the supply chain. Repeated visits enabled the collection of contemporary evidence and the development and testing of the causal relationships. This case was part of a multi-case research project that explored the causal relationship between variation, uncertainty, performance trade-offs and buffering mechanisms (time, capacity and inventory).

Findings - The case analysis demonstrates how established theory and causal reasoning can be used to explain the trade-off oscillations that characterized this case. As with earlier studies, local cost considerations predominated, interspersed with strategic countermeasures. Fisher's (1997) concept of coordinated strategies is shown to provide an effective means of clarifying the trade-off implications of the transition in support of proactive realignment. This concept is discussed in relation to other cases and literature before proposing how this could be developed and used as a basis for further research.

Practical implications – Supply chain redesign is of growing importance and with it the need to more effectively manage such transitions. This paper clarifies the need for supply chain orientation and offers means of clarifying the implications of such transitions to management.

Originality/value – This paper provides case evidence of the underlying operations management issues and the associated analysis.

Keywords: strategic trade-offs, process improvement, postponement, buffering

Paper type: Case

1.0 Introduction

The central importance of understanding the management of flows across companies and supply chains has been recognized for over 50 years (Forrester 1958) and very effectively demonstrated through automotive supply chain developments led by Toyota (Ohno, 1988). However, this is not so evident in environments that are more dynamic and particularly where there is a major transition that requires realignment.

Forrester (1958, 37) believed that management in the future would benefit from understanding,

"the way these flow systems interlock to amplify one another and to cause change and fluctuation will form the basis for anticipating the effect of decisions, policies, organizational forms, and investment choices.".

Since then theory and basic analytical approaches have complimented this seminal work across Production Operations Management (POM) and Supply Chain Management (SCM), which is now firmly embedded in MBA educational programmes. However, it is clear that this theoretical understanding is not always apparent in practice (Storey et al., 2005; Stratton, 2012). Theory should help management anticipate the effect of decisions, which is particularly relevant where there is a transition with strategic implications, referred to here as a strategic transition. Such transitions involve either radical changes to the supply chain design, as in moving to offshore supply (Storey et al., 2005), or changes to product offerings, as in a

'*strategic shift from cost leadership (through process management) to differentiation based on radical product innovation*' (Melnyk et al., 2010).

All of these exploratory research case studies identified a lack of awareness of the implications of such transitions, which raises questions concerning the level of supply chain orientation (Mentzer et al., 2001) and the practical nature of the associated theory and tools to support this process. This paper uses a longitudinal apparel case (Peterson's), involving a major supply chain transition, to investigate this further by exploring the utility of established trade-off related theory in this area and specifically Fisher's (1997) concept of coordinated strategies and his associated trade-off model. This case forms part of a multi-case research project focusing on key phenomena and their relationships to each other, namely: variability, demand uncertainty, performance trade-offs and buffering mechanisms (time, inventory and capacity).

The question addressed through this case are:

1 How does established theory practically support POM and supply chain realignment following a strategic transition?

2 How can Fisher's model and concept of coordinated strategies (1997) be used to support explanation and prediction in managing a strategic transition?

The paper is structured as follows. Section 2 reviews the literature concerning the trade-off concept and its prominence in POM and supply chain theory. Section 3 describes the research methods used in the study. Section 4 describes the case transition involving the response of Peterson's and the subsequent trade-off induced oscillating behavior. Section 5 analyses and discusses the case in terms of the identified constructs. Fisher's (1997) model and coordinated strategy concept is used and further developments proposed to enhance utility. Section 6 draws out the main findings, wider implications, limitations and suggestions for research.

2.0 Background Literature

The literature review is structured around three strategic perspectives in production operations and supply chain strategy that are used to justify the construct relationships of interest and subsequently used in the selection of the Fisher (1997) model as a basis for the case analysis.

2.1 *Trade-off led strategic perspective*

The origins of the manufacturing strategy concept dates back to the 1960s when Skinner's seminal articles (1969; 1974) highlighted the importance of aligning operations management decisions around strategic rather than conflicting local priorities (Baker and Kropp, 1985). The trade-off classification of process types followed (Hayes and Wheelwright, 1979), as did the importance of the market in determining the strategic focus. This resulted in the wide adoption of the concept of market order winning and qualifying criteria (Hill, 1985). Hill's model (1985; 2000) provided a framework to align the criteria with structural and infrastructural choices. His subsequent case research (Hill et al., 1998) demonstrated the need to realign such choices on an on-going basis due to either incremental or step changes in the strategic position. The use of the trade-off concept was extended to embrace the supply chain by Fisher et al. (1994; 1997) who used case research to develop his widely cited conceptual model (1997). However, the dominance of the trade-off model went into sharp decline in the late 1980s with a growing awareness of the apparently trade-off free improvements achievable through process management strategies.

2.2 *Process management led strategic perspective*

The strategic role of process management emerged in Japan where the importance of reducing variation and uncertainty across the supply chain and the associated waste was exploited by Toyota from the 1950s. This development addressed the need to control variation in the product (Shewhart, 1939; Deming, 1982) and the production system (Ohno, 1988; Shingo, 1989), thereby eliminating waste and improving the overall flow. Japanese industry led these developments in the 1970s and by the 1980s their international success drew attention (Hayes, 1981) which resulted in the strategic importance of the trade-off led strategy development being challenged. The Toyota Production System (TPS) (Womack et al., 1990) termed lean manufacturing, demonstrated how reducing wasteful variation and uncertainty in the product, process and demand profile improved all performance measures without trade-off consequences. The concept of cumulative capability and the associated sand cone model (Ferdows and De Meyer, 1990) followed. This is referred to as the law of cumulative capability (Schmenner and Swink, 1998) and remains a prominent theoretical model today (Ferdows and Thurnheer, 2011). Although this theory did not deny the significance of the trade-off concept it was realized at that time that there was much more to be gained by adopting process management strategies that reduced the underlying variability and associated waste, thereby reducing the perceived importance of performance trade-offs. Growth in supply chain literature soon acknowledged the importance of lean supply that particularly emphasized the need for demand stability across the supply chain (Ohno, 1988; Stalk and Hout, 1990). Having established the importance of stable and level demand it quickly became evident that product demand patterns often do not fit a lean manufacturing strategy. To address the need for an approach that encompasses volatile demand and short product life cycles the term 'agile' (Iacocca Institute, 1991) was coined to classify best practice at the other end of the stability spectrum to that of 'lean' (Naylor et al., 1999).

The concept of agile supply is now widely used by practitioners and academics but there continues to be limited agreement over its definition (Naylor et al., 1999; Gunasekaran and Yusuf et al., 2002; Christopher et al., 2004; Narasimhan et al., 2006) and it is commonly presented as providing the performance management improvements of lean supply without the need to make trade-off choices. The lack of theoretical explanation with empirical support make such claims more aspirational (Storey et al., 2005) and potentially contributory to the poor management awareness of the associated trade-off implications (Stratton, 2012). Having said that, agile delivery systems are closely associated with the last of the strategy developments addressed here, termed postponement / separation.

2.3 *Postponement / separation led strategic perspective*

Postponement strategies limit the degree to which process variation and demand uncertainty penetrates a supply chain through delayed product differentiation that is commonly referred to as the order penetration point (OPP) (Olhagar, 2003). Postponement is typically in terms of time, place and form (Bowersox and Closs, 1996) and the associated strategies encompass the interaction of customer data, operations management and product design (Van Hoek, 1998). This work emphasized the proactive involvement of marketing, design and supply chain operations in managing the impact of demand uncertainty driven trade-offs. Various authors (Zinn and Bowersox, 1988; Waller et al., 2000; Olhagar, 2003, Yang, et al., 2004) have identified how design can provide a means of demand aggregation via upstream standardization and in such cases the supply chain is effectively separated by decoupling inventory which limits the impact of demand variation and uncertainty on the supply chain.

Such developments are closely associated with mass customization (Pine, 1993; Fitzingler and Lee, 1997) enabling the classic trade-off between efficiency and responsiveness to be mitigated (Waller et al., 2000). As already mentioned, postponement is also increasingly identified as a major component of agile delivery systems (Vonderembse et al., 2006; Krishnamurthy and Yauch, 2007); Naim and Gosling, 2011).

The strategic importance of separating out a supply chain is also evident in trade-off led strategy developments associated with the focused factory (Skinner, 1974). These were typically classified by the level of variability (Hayes and Wheelwright, 1979) which were allied with different market order winners and qualifiers and, therefore, separately focused business units (Hill, 1985; 2000), as with the decoupled echelons in a supply chain.

2.4 *Theoretical unification of these strategic perspectives*

There is clearly a need to unify these perspectives within one model, which is particularly the case with the trade-off led and process management led strategy developments. Notable attempts at this have involved the concept of a moving trade-off frontier (Clark, 1996; Hayes and Pisano, 1996) that is typified by the theory of performance frontiers (Schmenner and Swink, 1998). This theory holds that although trade-off frontiers exist the operating frontier can be moved, so improving performance and cost simultaneously. This is achieved though process management strategies that effectively reduce variability and improve the flow, as conveyed in the theory of swift and even flow (Schmenner and Swink, 1998). These models implicitly embrace the chosen constructs but these have been more explicitly expressed by Hopp and Spearman (2000) in clarifying these underlying relationships in their law of variability and law of variability buffering.

- *Law (Variability): Increasing variability always degrades the performance of a production system.*
- *Law (Variability Buffering): Variability in a production system will be buffered by some combination of Inventory, Capacity and Time.*

Although these laws were originally derived with regard to POM environments they have been extended to embrace supply chains principles (Hopp, 2008).

Fisher's (1997) matrix model can also be used to effectively unify these strategic perspectives and the associated case research (Fisher et al.,1994; 1997) embraces the integration of these three strategic perspectives within a supply chain model, utilizing the chosen constructs. Of particular note is Fisher's use of Coordinated Strategies (FCS) which are developed further in this case paper. The rationale for the choice of Fisher's model in the case evaluation is the focus of the next section.

2.5 *Fisher's supply chain management model*

Fisher's (1997) model (Figure 1) highlights the need to align the design of the supply chain with the nature of the product demand, embracing the concepts of uncertainty, trade-offs and buffering mechanisms (capacity, inventory and customer tolerance time). Fisher (1997) used case research to clarify the trade-off relationship between different levels of demand uncertainty and the choice in supply chain design between efficiency and response (Fisher et al., 1997).

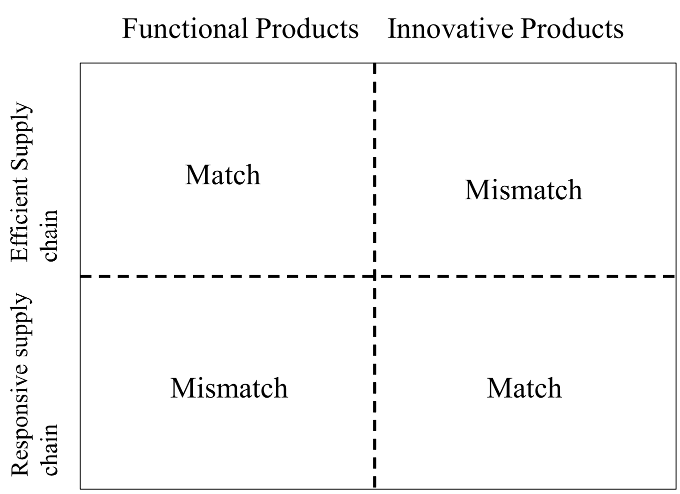

Figure 1. Matching Supply Chains with Products (Source: Fisher, 1997, p109)

The concept of an efficient supply chain is therefore associated with minimal buffering (Hopp and Spearman, 2000) which is aligned with functional products and minimal demand variation and uncertainty. In contrast innovative products are associated with demand uncertainty and responsive supply chains, hence strategic buffering. Fisher particularly highlighted the market mediation losses resulting from not aligning innovative products with a responsive supply chain. To support the thinking behind the model Fisher advocated consideration of three Coordinated Strategies (FCS) in seeking to improve supply chain performance.

FCS 1 "Strive to reduce uncertainty (e.g. timely demand data or common parts)."

FCS 2 "Avoid uncertainty by cutting lead-times and increasing the supply chain flexibility so that it can produce ideally within the tolerance time of the customer."

FCS 3 "Once uncertainty has been reduced or avoided as much as possible, hedge against the remaining residual uncertainty with buffers of inventory or excess capacity."

(Fisher, 1997: 114)

These coordinated strategies emphasise demand uncertainty rather than wider sources of variation, however, they implicitly encompasses the concept of postponement, buffering and the trade-off implications. These coordinated strategies will be subsequently discussed and refined in the light of the case findings.

Fisher's associated model (1997) is considered to be a seminal development that is widely used as a basis for survey based research (Selldin and Olhager, 2007; Sun et al., 2009; Harris et al., 2010) and teaching (Slack et al., 2010:148).

The interest in the model has resulted in many authors exploring its development through case study. These include Heikkila (2002) who advocated the use of order winning criteria OWC to differentiate the market and De Treville et al. (2004) who explored the importance of shortening lead times as a priority in managing demand uncertainty. Others have extended the model using more complex constructs, such as 'agile' (Lee, 2002; Christopher et al., 2006). However, none of these developments were looking specifically at interpreting the implications of strategic transitions, although it has been used in the analysis of duel sourcing strategies (Stratton and Warburton, 2003). Mindful of these developments the original model and associated coordinated strategies have been used as a starting point in this case analysis. This is primarily due to its simple alignment with the key constructs identified subsequently. .

3.0 Research Design

This case formed part of a wider research project where the research questions centred on clarifying the key concepts/variables and their relationship to each other. Such research is clearly suited to multiple case research (Melnyk and Handfield, 1998; Voss et al., 2002; Yin, 2003). Eisenhardt's (1989) theory building process was followed, commencing with tentative propositions/hypotheses that are progressively developed through the focused analysis of cases (Miles and Huberman, 1994). The case analysis involved inductive analysis of transitions in the level of stability (process and demand), with a particular focus on the trade-off performance associated with changes in the choice and level of buffering mechanism. The interview process was designed to take an overview of the immediate supply chain from the perspective of the company concerned before centering on any sustained transitions in variation, uncertainty and buffering mechanism. Such transitions provided the focus for data collection with reference to customer order winners and qualifiers, together with the nature and location of associated buffering mechanisms. Emphasis was placed on exploring changing trade-offs associated with the transition and the drivers and actions involved in reducing, mitigating and managing the trade-off implications.

This apparel case study (Peterson's) comprises three echelons in the supply chain with the focal company supplying directly to a major high street retailer in the UK. The case study covered 5 years which involved 6 site visits together with a retail customer survey and customer / supplier interviews. In total nine management interviews took place together with the collection of multiple sources of data.

The initial study took place in 2002 and involved and extended interview with the Managing Director, the Commercial Director and the Operations Director together with a tour of the facilities. These semi-structured interviews used the aide memoir in the first instance and a photographic record was taken to support the case account together with reports and records. One example of this involved a survey of key CAP retailer outlets that was used to independently clarify the level of market mediation losses, subsequently discuss with the retailer. Subsequent factory visits (5 in total) were time depending on notable developments following telephone updates made on a 6 monthly basis with the MD or OD. For example, an interview with an offshore garment supplier and a Buyer was arranged to coincide with their factory visit concerning a quality issue in 2003. An additionally interview with a Merchandiser was arrange to take place at the offices of CAP in 2005 following increased interest in the hybrid route resulting in sales of over 400,000 garments. The interviews were recorded and transcribed with the account being sent to the interviewees for correction and validation. Relevant internal reports and communications were provided to quantify and verify the key construct relationships of interest. The study concluded with a telephone interview with the MD in 2007 with the relocation of the garment dyeing facilities to lower cost countries, partly through joint ventures.

3.1 Construct definitions

The construct definitions adopted do not significantly differ from those used by other authors but the case evidence has been used to clarify how they have been consistently defined in relation to this and the other cases in the study. A commonly used term that embraces variation and uncertainty is variability (Hopp and Spearman, 2000), but due to the predominant reference to demand uncertainty, variation and uncertainty have been identified as separate constructs.

- Variability (demand and process): The level of non-uniformity of demand or output from resources within a supply chain. This may result from external demand variation (e.g. mix and volume changes) or internal process variation (e.g. set-up time).
- Demand uncertainty (forecast uncertainty): The level of unpredictability of the demand variability.
- Performance trade-off: In this research the term is linked to the buffer choices associated with managing flow in POM and SCM. In the case analysis this is linked to Hill's (2000) concept of order winning criteria (OWC) to differentiate between delivery speed and price as the dominant market requirements for the delivery systems considered.

Buffering mechanisms: The three buffering mechanisms (capacity, inventory and time) are closely allied to other authors, such as Hopp and Spearman (2000), however, the case context has influenced how buffer time in particular has been interpreted.

- Forward load: Actual or anticipated work waiting before the delivery system - normally measured in time. This can take the form of an order backlog associated with a variable extension to the lead-time.
- Inventory: In contrast to forward load inventory compresses customer response time by committing capacity in advance of demand at an intermediate or a finished stock level.
- Capacity: Providing capacity to manage variation and uncertainty directly was found to be achieved through proactive or reactive means. Proactive capacity

buffering would include arrangements such as annualized hours. Reactive capacity, as in overtime tends to be less certain and more expensive.

4.0 The Peterson's case

4.1 *Back ground to the supply chain transition*

Peterson's garment dyers was one of the largest garment dyeing facilities in Europe, combining expertise with the economies of a semi-automated plant which was part of a multi-million pound investment installed in the late 1990s. For several decades, it was part of the vertically integrated Group (FSP). Typical garment dyed products included knitwear, hosiery, and woven fabrics, but the technical requirements of knitwear had become their main focus of activity in recent years as this area of FSP business had proved more difficult to move offshore. Peterson's worked alongside local knitting and finishing factories in the design and development of garments as well as volume production. As FSP was a major supplier to high street retailers Peterson's had generally been made responsible for developing the seasonal colour pallets and recipes across their product ranges as well as supporting product development.

In 2001 FSP withdrew from garment manufacture, closing or selling off its interests in knitwear. Peterson's annual sales quickly fell from £15M to £5M and their full time workforce was subsequently reduced from over 500 employees to a little over 100, in their fight to remain in business under a management buyout. By 2002 one of their major retail customers CAP (not the actual name) still depended on them for the colour pallet and recipe specification, but few regular production orders remained. This retailer is specifically referred to in the case but is representative of others.

4.2 Typical product and dyeing process

Typical garment dyed products are often solid (single) colours, but the garment dyeing process can be very sophisticated. For example, by pattern knitting ecru (undyed) yarns with different dye resist properties the cross-dyeing process enables complex coloured patterns to be dyed into a garment. A wide range of fibres may be dyed in this way, including: lambs' wool, acrylic, cashmere, cotton, and mohair.

In the case of knitwear, as the name suggests, garment or piece dyeing involves dyeing the garment after it has been knitted in the natural colour of the fibres, referred to as ecru. The alternative is to use pre-dyed yarn to knit the garment. The garment dyeing facility at Peterson's comprises a wide range of chemical treatment processes, but the main capability is embedded in the semi-automated dye mixing and dispensing to the dyeing machines.

4.3 Original garment dyeing process route

Garment dyeing had advantages over yarn dyeing for both the supplier and the retailer and therefore had become a popular option when FSP was developing new products for their customers. Almost the first decision in the yarn dye manufacturing process is the colour choice, whereas with garment dyeing it is close to the last. Committing to a colour and quantity is a risk that worsens the further ahead you forecast, therefore, it is important to minimise the lost sales or excess stock by postponing this decision as long as possible. This need to delay colour choice also puts pressure on the seasonal workload for yarn dyeing and subsequent knitting in an attempt to delay the start of production. Therefore, there has been a constant tension over the years between the manufacturer attempting to efficiently smooth his capacity demand by insisting on longer lead-times and the retailer compressing the lead-times. FSP was also commercially aware of this conflict as it was common practice for them to share the losses associated with excess stock at the end of a season. The neat advantage offered by garment dyeing was the partial separation of these two conflicting requirements. The knitting factory was able to start manufacturing garments as soon as the styles were agreed, typically much earlier, without having to wait for colouring decisions and dyed yarn to be supplied. This use of ecru yarn also enabled longer production runs and fewer set-ups, which improved the reliability of the knitting process, as changing to different coloured yarns introduces process variation and associated quality issues and delays. Also, with ecru yarn there is no risk of running out of specific colours and, therefore, yarn wastage and shortages are reduced.

The garments were knitted at this stage in two pieces with the neck separate from the body. The garment was normally then stored ready for colour specific call-offs. With the colour recipe and treatments having been pre-specified, once the colour choice was made by the retailer, the ecru garments could be processed immediately, assuming dyeing capacity was available. The actual dyeing process can involve several semi-automated stages taking over 11 hours in total. Once dyed the body and neck were assembled at one of the local satellite finishing factories, where labels were attached and the garments pressed and packed for dispatch to the retailer's distribution depot. Figure

2 illustrates this onshore process.

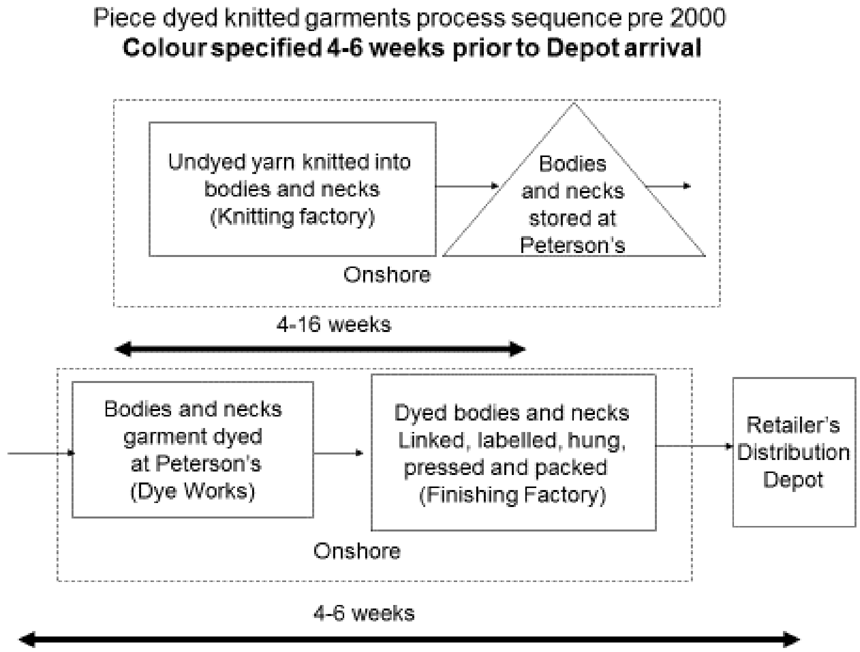

Figure 2 Original piece dyed knitted garments process sequence

Although this route enables the colouring decision to be made much closer to the time of sale, typically 4-6 weeks, there was commonly pressure to delay the colouring decision still further. It was, therefore, common for these finishing satellite factories to need to respond to significant peaks in demand as garments were prepared for the start of the season, commonly resulting in workers being laid-off then reemployed a few weeks later.

The reasons for not assembling the knitted garment before the dyeing process, and therefore relieving this uneven demand profile further, was discussed in the mid-1970s when the dyeing of fully assembled garments was popularised by Benetton. However, at that time the benefits were not seen as significant and therefore the process was not developed. The Commercial and Operations Director at Peterson's recalls visits to Benetton's Dye Works in Italy in the mid 1970's and subsequently doing dyeing trials with the neck attached while he was working as the Dye House Manager at Courtaulds, another major high street retail supplier. These trials, around 1977, were successful but the process was never put into production. One of the main arguments against this new development, as he recalls, was that the knitting factory production costs were higher than the finishing factory and a finishing stage would still be required.

> *"Courtaulds and FSP saw little benefit in introducing such a change and, therefore, the capability was not developed until after 2001. Old habits die hard though, and we are still dyeing the necks separately for one of our customers even today."* (Operations Director)

4.4 The yarn dyeing processing route

Although other parts of FSP's operations, such as men's shirts, had been progressively moving offshore over several years, knitwear was more specialised and not so well progressed by 2001. With the loss of the FSP supply chain the retailers rapidly became much more dependent on offshore supply, initially via other intermediate UK suppliers, but increasingly dealing with the offshore suppliers direct. However, the Far East manufacturer's utilised yarn dyed routes rather than garment dyeing, therefore significantly increasing the colour choice lead time. This typically increase the colour choice lead-time to 18-20 weeks, over three times greater than that offered by the FSP. This was due in part to the garment dyeing option not being readily available. In the meantime, Peterson's survived on ad hoc orders and the regular need to refurbish or recolour garments as illustrated in Figure 3.

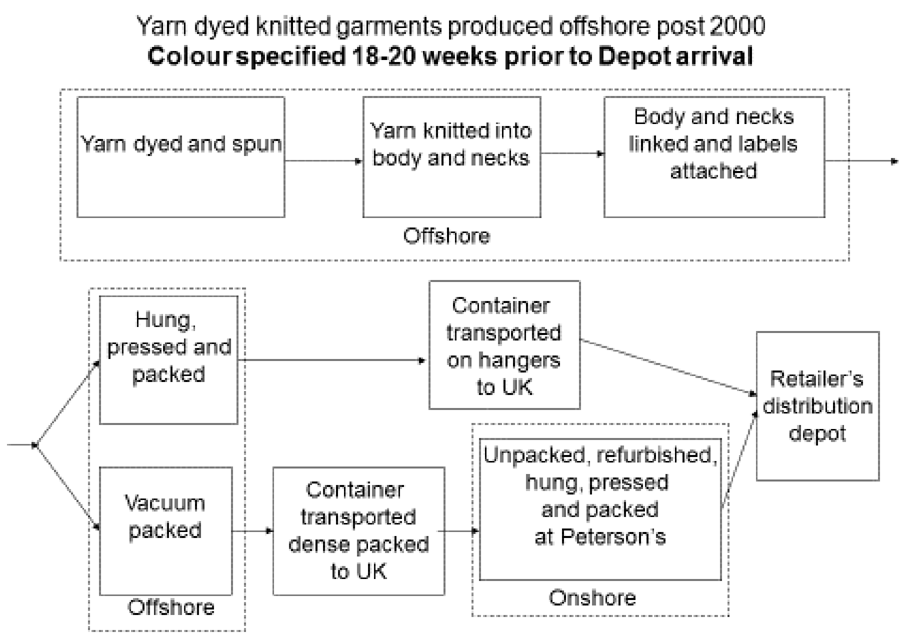

Figure 3 Yarn dyed knitted garments process flow and Peterson's limited involvement.

Peterson's, now part of a management buyout, realised they needed to offer a dyeing and finishing process in one if they were to have any chance of winning back dyeing work based on fast response. The finishing processes they introduced involved steam pressing, labelling and packaging on hangers ready for retail stores.

This initially enabled Peterson's to take advantage of the growing demand for refurbishing garments transported here close packed, typically from the Far East, and preparing them for retail display (see Figure 3). This rapidly growing market helped to sustain sales revenue levels but typically at a low unit price as it did not take advantage of their dyeing capability. Fortunately, an additional source of revenue was also available in the form of recovery work from overseas. For example: fixing a dye, making the garment machine washable, or even re-dyeing. The cost of such recovery could range from £1-50 to £3-00 per garment.

At the same time it was increasingly evident that the increase colour choice lead-time from 6 to 18 weeks had a marked impact on the responsiveness of the supply chain, effectively moving the fashion coloured products into the mismatch zone on the Fisher model (See Figure 4) illustrated by the case quote below,

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> *"one year there was wall to wall burnt orange everywhere. I would like to think that would not happen today."* (CAP merchandiser)

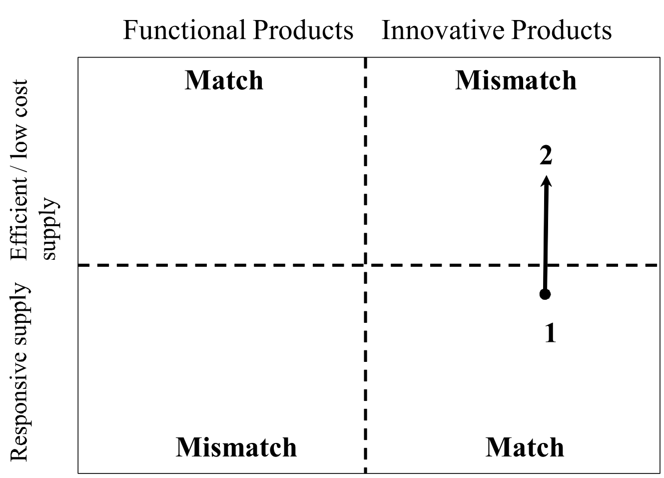

Figure 4 The implications of colour choice lead time increasing from 6-18 weeks (1-2)

The resulting market mediation losses were also evidenced by a survey of CAP retail stores in 2002. This survey identified market mediation problems resulting in excesses and shortages based on colour rather than style. This was acknowledged by CAP senior management but the solution was largely left with middle management, who resolved the conflict at an operational level by restricting the colour range.

The colours were restricted to what was referred to as a *'narrow and deep'* colour range that exhibited more functional than innovative characteristics as illustrated in Figure 5, so moving the product into the functional / efficient match zone (move 2-3).

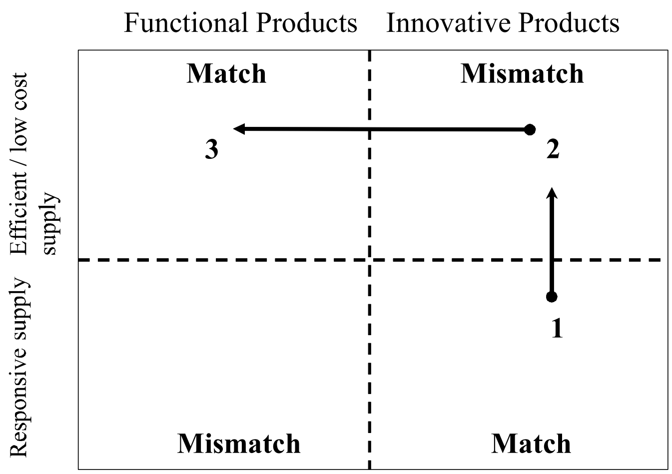

Figure 5 To reduce the market mediation losses the colour range was restricted (2-3)

4.5 The hybrid offshore onshore garment dyeing process route

For long-term viability, Peterson's needed to exploit their fast response capability that their dyeing facility could offer on regular orders. To do this they introduced a finishing facility that enabled the dyed garments to be complete on hangers and dispatched from Peterson's to the retailers. With this capability, they initially promised a five-day lead-time from colour choice to retail distribution depot, in reality this could be 10 days when dealing with peak demand, due to labour shortages rather than dyeing capacity (See Figure 6).

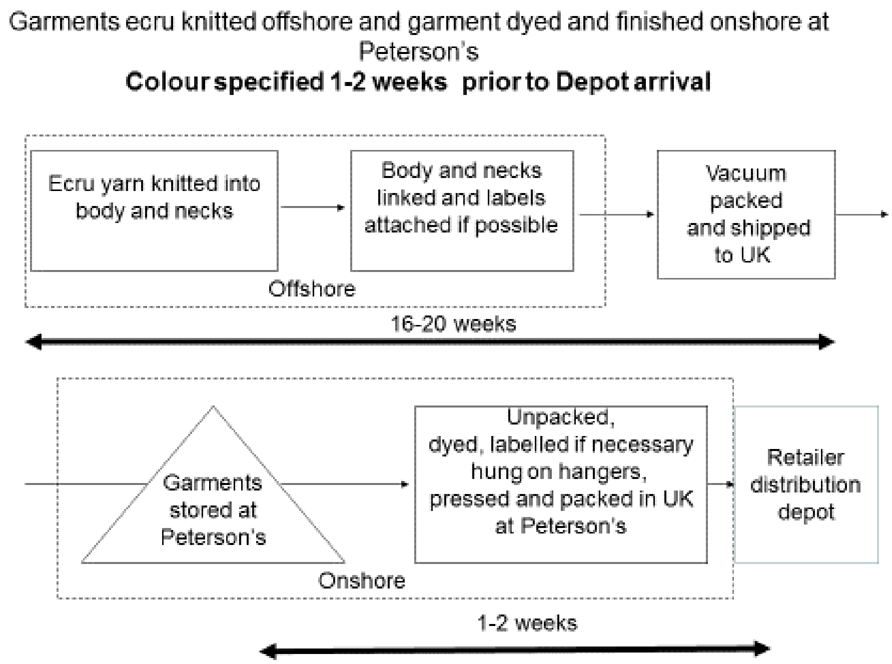

Figure 6 Hybrid option: ecru knitted offshore then dyed and finished at Peterson's

The principle they worked to was postponing the colour choice but minimising all other activities that could be done offshore. They had now perfected the process where the neck was attached offshore, and where feasible the garment labels also could be attached offshore. Where labels needed to be attached they also needed fast response from the label supplier once the colour had been agreed. The typical price charged by Peterson's for this service was £3-00 which provided a significant barrier even though much of this cost could be offset by the reduced offshore processing and transport costs as outlined in Figure 7. However, these savings would need to be effectively managed if they were to be realised and this was a further level of complexity for the Buyer.

	£
• Ecru versus dyed yarn	1.50
• Wastage of dyed yarn	0.15
• Reduced import duty	0.20
• Cost of scour	0.33
• Cost of pressing	0.05
• Cost to label and pack	0.07
• Reduced transport costs	0.20
TOTAL	**2.50**

Figure 7 Claimed savings associated with the garment dyeing option

In addition to these more quantifiable savings there are significant operational benefits associated with the offshore knitting factory being able to smooth out the seasonal load. As mentioned earlier, with yarn dyeing the late release of the colour choice results in a very tight schedule during the peak manufacturing period with little opportunity to buffer against uncertainty, consequently, it was not uncommon to have the additional cost of airfreight. However, these wider supply chain design benefits need to be strategically managed, ideally through long-term relationships.

4.6 Reconciling the cost versus response trade-off and strategic oscillation

> *We have put more colours back in the last couple of years because we have felt more confident. In previous years, we either bought a tiny amount of it and ran out or we had an excess.*
> (CAP Merchandiser)

The adoption of a "*deep and narrow"* colour range addressed the issue at the operational level of the Buyer/Merchandiser but it compromised the strategic offering to the market which periodically came to the fore, often resulting in Peterson's hybrid garment dyeing route being adopted at short notice. The reference to putting the colour back, in the above quote, relates to a time when significant use was being made of Peterson's which in turn had been driven by senior management intervening as evidenced below (Figure 8).

"There was pressure to extend the colour range in 2005 and we knew we had to do it in such a way that the markdowns were not compromised… We had to provide more colour and we asked how do we go about doing that and we came by this route of making them in the Far East and dyeing them in the UK."
(CAP Merchandiser)

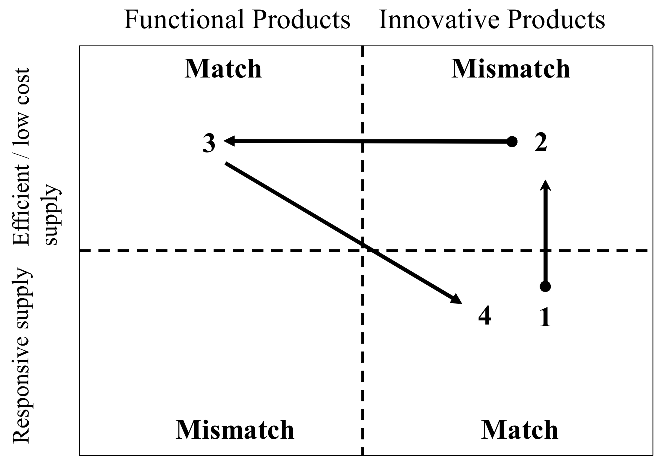

Figure 8 The limited colour choice resulted in the CEO insisting on certain fashion colours and the adoption of the hybrid route (3-4)

Note that the Merchandiser was unaware of this route even though the technology had been a well-established part of their supply chain for years and Peterson's had this hybrid route operating for over two years at this time. The reference to pressure to extend the colour range is exemplified by an instruction one spring to have certain fashion colours in the major stores by Easter, which was just three weeks away. Such initiatives forced greater awareness of the garment-dyeing route offered by Peterson's, but the dominance of numerical performance metrics, in this case gross margin, remained. This is illustrated by a ladies wear Merchandiser using the Peterson's route in 2005/6 for 400,000 acrylic jumpers. This had worked well and the Merchandiser was anticipating using Peterson's in a similar way the following year. However, as on previous occasions, a change of Merchandiser resulted in the yarn dyed route being favoured and orders for Peterson's hybrid route rapidly declined once more.

This oscillation in the use of the garment and yarn dyed route was a repeating pattern of behaviour over the period from 2002 – 2006 and symptomatic of the trade-off between cost and response that was addressed in this manner by CAP and other retailer customers. Over time the response capability provided by offshore supply inevitably improved, not least because garment-dying technology was becoming more readily available in the Far East.

4.7 The eventual transfer of the facility and expertise offshore

With increasing utility costs and on-going price pressure the Peterson's UK facility was eventually transferred together with expertise to partners in Sri Lanka and Bangladesh with the UK facility finally being closed in 2007. Some of their retail customers continued to use this facility in Sri Lanka where the shipping time is three weeks making the colour choice response time five weeks by ship and two weeks by air. It was noted by Peterson's management that the two-week response cost was about the same as that offered by Peterson's UK operation, the main distinction being the flight costs are not always required.

5.0 Findings and Discussion

The findings firstly summarise the nature of the transitions before discussing the interpretation via Fisher's matrix model. Two areas of development are then identified, one concerns the oscillating behaviour and the other concerning Fisher's coordinated strategies. Generalised findings are then explored and discussed with regard to the questions.

5.1 A summary of the strategic transitions

The transitions and the associated use of buffering is outlined in Table 1, which summarises the relationship between the different constructs over the three supply chain design states, namely:

- the original onshore route
- the offshore yarn dyed route
- the hybrid offshore - onshore route

Original onshore route (pre 2001)

The garment dyeing capability enabled undyed garments to be produced well in advance of the season, therefore, enabling low demand variation and uncertainty at the knitting stage due to colour postponement. This enabled the use of forward load and inventory buffering without the risk of obsolescence (Table 1 – row 1).

The garment dyeing and finishing process (Table 1 - row 2) provided a 4-6 week response to the retailers colour choice that due to the short lead time limited colour uncertainty and the aggregated demand variation was buffered using capacity buffering at the finishing factory.

Table 1 Summary analysis (the number of ' √' represents relative weighting of buffer choice before and after the related case transition)

Peterson's	**Order winners** (Hill, 2000)	**Colour Choice Lead time**	**Demand Variation & (Uncertainty)**	**Internal Process Variation**	**Buffering Mechanisms**		
	Price (P) Delivery speed (DS)	Long Short	Mixed High Low	Batch size	Forward load	Inventory	Capacity
- FSP							
-onshore	P	N/A	Low (Low)	Large	√√	√√√	
-onshore	DS	Medium	Medium (Med)	Small		√	√√
- Offshore only	P/DS	Long	Low (High)	Large	√	√√√	
-Hybrid							
- offshore	P	N/A	Low (Low)	Large	√	√√√	
- onshore	DS	Short	High (Low)	Small		√	√√√

Offshore yarn dyed route (Post 2001)

The move to offshore supply meant yarn dyeing replaced garment dyeing, resulting in up to a 20week colour choice lead-times. This increased lead-time resulted in the need to hold finished inventory where the demand uncertainty on the fashion colours was very high, resulting in high market mediation losses (obsolescence and shortages). As a consequence of the resulting lead-time pressures on supply there was little opportunity to smooth demand through forward load and capacity buffering (Table 1, row 3).

Hybrid offshore-onshore route (2002-2007)

Ecru garments are knitted offshore enabling long production runs (lower process variation) with much lower demand variation and uncertainty due to aggregation made possible through colour postponement. This again enables production to be smoothed by exploiting a forward load buffer that results in ecru garment inventory being held at Peterson's (Table 1 – row 4).

With the adoption of garment dyeing the 5-10 day colour response resulted in the need for increased capacity buffering (Table 1 – row 5) via excess dyeing capacity and annualized hours contracts in the finishing process.

5.2 Mapping the transitions onto Fisher's matrix model

- Fisher's (1997) model has been modified to link low cost with 'efficient' supply as the offshore option was driven be cost. Also Fisher's reference to 'functional' and 'innovative' products has been replaced by the underlying demand uncertainty. This is consistent with Fisher's (1997) argument and others (Lee, 2002; Christopher et al. 2006) and better reflects the more abstract issues addressed in this case.
- Figure 9 conveys the implications of the two transitions in the Peterson's case as follows.

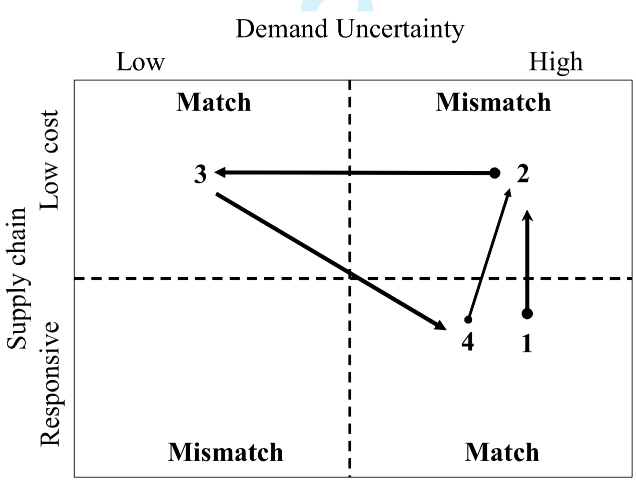

Figure 9 The cyclic behaviour following the initial transition with proposed changes to the axes

- 1-2 The move to low cost yarn dyed offshore supply increased the colour choice lead time which resulted in excessive obsolescence and shortages (market mediation losses) associated with the mismatch zone (upper right quadrant).

- 2-3 To address the obsolescence the colour range is restricted, effectively repositioning the products from innovative to functional reducing the demand uncertainty. Stage 3 suggests a match has been achieved but only at the expense of limiting the offering to the market.
- 3-4 The CAP CEO/Marketing responds by demanding fashion colours are reintroduced, which are provided via the Peterson's hybrid garment dyeing route.
- 4-2 The CEO/Marketing intervention was short lived, in this case due to job rotation and the cycle repeats itself, resulting in repeated switching between the offshore and hybrid supply routes, with corresponding adjustments to the colour range.

The Fisher model can also be usefully used to convey the effect of separating the supply chain by postponing the colour choice, as illustrated in Figure 10.

5.3 Transition instability and its causes

Although the model can be effectively used to capture the three transition states, what is of particular interest in this case analysis is the tension between the offshore and hybrid supply routes that resulted in the periodic switching from one to the other. With the closure of FSP and the transition to offshore supply the structural mechanisms underpinning the strategic alignment were effectively removed leaving the supply sourcing decisions largely the discretion of the CAP Merchandisers / Buyers. With cost reduction being the driver of this transitional change and the sourcing decisions being relegated to an operational level it might be expected that cost would be the primary

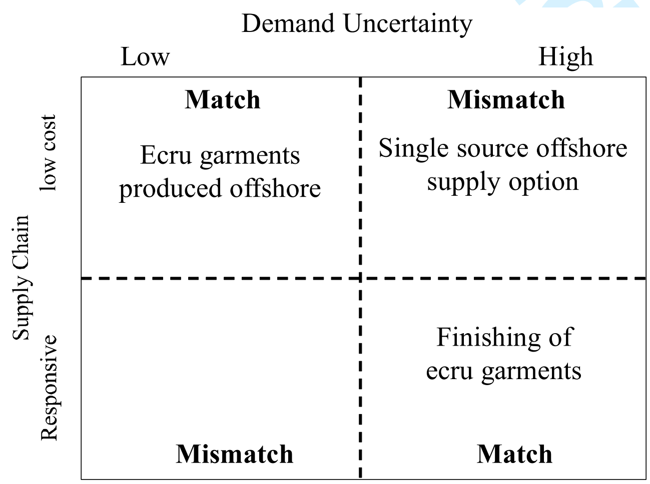

Figure 10 Realigning the supply chain using modified axes

consideration, and in this case the primary measure of performance was gross margin (ie planned sale price minus purchase cost). Consequently, the natural operational focus was on purchase cost and when the offshore supply led to high levels of market mediation losses, *'burnt orange everywhere'*, the risks were mitigated by the Merchandiser limiting the product range, hence the reference to *'deep and narrow'*. This, however, was clearly in conflict with the senior management concerns over displaying the latest fashion colours, which periodically resulted in direct intervention, as exemplified in the case account. Over time, the Merchadiser/Buyer came to understand the need to resolve this conflict, but the sourcing decision regarding the use Peterson's garment dyeing capability remained with them. Consequently the regular change in Merchandiser/Buyer repeatedly resulted in the dominant cost focus resulting in the adoption of the lower cost option unaware, at least initially, of the wider system implications. Such behaviour has been identified as a manifestation of the underlying system design conflict resulting in planned and unplanned balancing behaviours (Senge, 1990), this also evident in what Deming referred to as the 'deadly diseases' (Deming, 1982) associated with job rotation.

Figure 9 conveys this mismatch and attempts to encompass the resulting transitional instability of the supply chain demonstrating the lack of supply chain orientation (Mentzer et al., 2001). Although this diagram conveys the misalignment problem it does not address the actions necessary to resolve it. For this Fisher (1997) advocated the use of three coordinated strategies (FCS) that provided management with three areas for strategic improvement that needed to be considered in combination, hence the reference to coordination. These FCS are discussed below in the context of the case and the wider literature review.

5.4 *Interpreting Fishers Coordinated Strategies (FCS)*

Fisher's Coordinated Strategies (FCS) were found to be generally applicable but there were ambiguity issues in interpreting these strategies using the research constructs. These are discussed below before proposing revisions.

- *1 "Strive to reduce uncertainty (e.g. timely demand data or common parts)."*

The importance of reducing uncertainty is clear but it is not so clear why timely demand data has been grouped with common parts. Timely demand data will improve the forecast by reducing the forecast horizon. However, this is distinct from the process and design changes needed to incorporate common parts. The adoption of garment dyeing equates to the ecru garments being the common parts and it is proposed to classify as a distinctly different coordinated strategy.

- *2 "Avoid uncertainty by cutting lead-times and increasing the supply chain flexibility so that it can produce ideally within the tolerance time of the customer."*

The distinction between reduce (FCS1) and avoid (FCS2) is unclear. For example, reducing the lead-time will reduce the uncertainty associated with forecasting but not avoid it completely, as in the case of reducing the colour choice lead-time. The use of the term flexibility is also ambiguous as it could mean reduced variation, or the increased use of buffer capacity?

- *3 "Once uncertainty has been reduced or avoided as much as possible, hedge against the remaining residual uncertainty with buffers of inventory or excess capacity."*

This final coordinated strategy is focused on the need to buffer uncertainty but does not explicitly address the trade-off implications of the alternative buffers. In the Peterson's case, whereas ecru garments could be buffered through inventory, the garment dyeing and finishing process needed to be able to respond rapidly, therefore, embrace a proactive capacity buffer.

5.5 Proposed revisions to Fisher's coordinated strategies

The case evidence was found to naturally supported the idea of three coordinated strategies as advocated by Fisher but these coordinated strategies have been redefined to provide greater clarity over three explicit means of reducing and managing uncertainty (and variation) utilizing the selected constructs.

- *CS1 Buffer the variation and uncertainty.*

  This CS is allied with the trade-off led strategy perspective in the literature review but more specifically acknowledges the trade-off implications of the buffering choices (capacity, inventory and forward load) in relation to the supply chain priorities –e.g. order winning criteria (Hill, 1985). This largely replaces CS 3 but stresses the linkage between buffer choice and order winning criteria, i.e. delivery speed and price in the Peterson's case.

- *CS2 Reduce the variation and uncertainty*

  This CS is aligned with the performance management strategy perspective in the literature review and, therefore, akin to reducing variation and uncertainty that effectively drives the need for buffering and the associated trade-offs. This is akin to Hopp and Spearman's (2000) law of variability and encompasses both 1 and 2 with the exception of reference to common parts in FCS1. The demand and process stability associated with the ecru knitting is most closely associated with this CS.

- *CS3 Separate or postpone the variation and uncertainty*

  This CS is directly aligned with the postponement/separation related strategy developments covered in the literature review. This FCS embraces 1 in part, encompassing the reference to common parts but more explicitly allied with the associated literature. This coordinated strategy is closely associated with product and process design, enabling variation and uncertainty to be limited to the latter stages of the supply chain, as in the case of Peterson's garment dyeing. This GS is more structural in nature and typically requires more advanced planning to ensure associated technology is available and embedded in the process.

The chosen constructs have been explicitly used in the definition of these coordinated strategies with the aim of clarifying how these strategies are inter-related and, therefore, need to be coordinated. They necessarily encompass both process management (CS2) and alignment strategies (CS1/CS3) and any change in variation and uncertainty or the order winning criteria demands a corresponding alignment change. This is consistent with the earlier cited research that identified these strategic directions; however the use of the common constructs in defining these CS helps clarify the causal links.

It is proposed that these coordinated strategies provide a simpler and more coherent means of explaining the strategic options and how they interrelate; therefore, clarifying the need to realign these coordinated strategies when subject to a transition, as illustrated below in Figure 11.

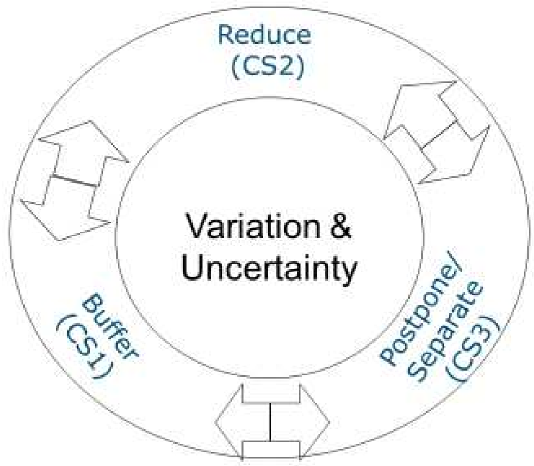

Figure 11 - A conceptual model showing the inter-relationship between the Coordinated Strategies (CS)

The following description of the implications of the three transition states illustrates the interplay between these coordinated strategies.

Original onshore route

Over many years FSP had introduced garment dyeing as a means of postponing the colour choice (CS3) and so enabling the knitting process to be decoupled from the uncertain colour choice. This enabled inventory buffering (CS1) to be used to protect the stability of the knitting process, which due to the ecru yarn was subject to less process variation (CS2), so reducing the yarn inventory levels (CS1). Due to the need to keep the colour choice lead-time short (6 weeks) capacity buffering (CS1) was needed at both Peterson's and the finishing factory. There was, therefore, equilibrium in the strategic choices prior to the transition.

Offshore yarn dyed route

The desire to reduce cost resulted in the move to offshore supply which increased the supply lead-time and, therefore, demand uncertainty (CS2) which was compounded by the adoption of a yarn dying process (CS3) i.e. no postponement, which in combination extended the colour choice lead-time three fold increasing demand uncertainty (CS2). This in turn required the holding of increased finished inventory (CS1) and due to no postponement (CS3) there is a need to reserve offshore knitting capacity (CS1) in peak periods. This inevitably positions fashion colours in the mismatch zone (Figure 6) and with it the associated obsolescence and shortages. To address this problem the colour range is narrowed by the Buyer/Merchandiser, reducing the demand uncertainty (CS2) and product range (CS2). This enabled forward load buffering (CS1) of the offshore supply and reduced the market mediation risks associated with finished inventory buffering (CS1). An equilibrium of sorts was reached, but one driven by the limitations of the supply chain design rather than the needs of the market.

Hybrid onshore-offshore route

The market demand for fashion colours results in a wider colour range being insisted on by senior management that increases the demand uncertainty and process variation (CS2). This demand uncertainty is again reduced by postponing colour choice (CS3), this time with a 10 day lead time enable finished inventory (CS1) to be replaced with buffer capacity (CS1) at Peterson's. This enables the colour range to be widened with lower obsolescence and a strategic equilibrium is achieved, but the cost of production has risen. However, this senior management intervention is is only temporary and the local performance objectives of the CAP Merchandiser / Buyer reemerges resulting in a shift back to offshore yarn dyed supply. As a consequence there is the associated increase in colour choice lead time, therefore demand uncertainty (CS2) and pressure to limit the colour range to avoid market mediation losses.

These coordinated strategies can be mirrored in the Fisher model as shown in Figure 12 below reflecting the operations led, design led and market driven nature of these coordinated strategies.

6.0 Summary and conclusions

This case has described the trade-off implications of a strategic transition in the design of a supply chain and provided a means of exploring the utility of established theory. The review of literature identified the selected research constructs (variability, demand uncertainty, performance trade-offs and buffering mechanisms) which have been used to explore how the trade-off concept might be more effectively represented, with particular reference to Fisher's (1997) model and his coordinated strategy concept. The model proved effective at diagrammatically representing the transitions together with the interplay between supply chain design choices and the level of product innovation (demand uncertainty) offered. However, this diagram approach is limited in its ability to convey the causal reasoning that underpins the trade-off choices. This resulted in the development of the Coordinated Strategy (CS) concept that both embrace the constructs and the strategy led developments introduced in the literature review. These coordinated strategies, together with the underlying construct relationships, provide a means of explaining the need for alignment. It follows that any transition affecting one of the coordinated strategies will result in the need to realign at least one of the others.

As already identified in the introduction strategic transitions, in the form of supply chain design (Storey et al., 2005) or radical changes in the product offering (Melnyk et al., 2010), are commonly associated with misalignment issues. Both these cases also exhibited a lack of senior management awareness of their need to get involved with more proactive realignment and, as with the Peterson's case, this will need to involve consideration of performance metrics. It is interesting to note that Melnyk et al's. (2010) case research identified that metrics suited to process management led strategies (CS 2) are not suited to a trade-off led strategies (CS 1) which demands strategic choices to direct the infrastructural decisions. It may therefore be interesting to consider whether the shift in emphasis to process management led strategies (CS2) over the past 20 years has resulted in senior management being less aware of the trade-off implications (CS1/CS3) and the associated infrastructural issues exemplified in the performance metrics. The dominance of the process management view may also help to explain why agile and responsive strategies do not more actively acknowledge the trade-off implications of dealing with demand uncertainty.

Finally, it is proposed that these coordinated strategies provide a useful means of clarifying how these underlying construct relationships need to be actively considered by senior management, especially at times of strategic transition. However, it is acknowledged that further work is required to test and develop observations relating to a single case. Research is being developed to this end with the intention of exploring this realignment issue further, which involves targeting focal case companies within a supply chain exhibiting a strategic transition.

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