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ABSTRACT

In this paper we contrast the notions of best-practice and configurations contingent on environmental conditions. The analysis draws upon our study of 38 UK and 70 US service firms which includes an assessment of the organization, processes, tools and systems used, and how these factors influence variation in the development and delivery of new services. The best-practice framework is found to be predictive of performance improvement in samples in both the UK and USA, but the model better fits the USA than UK data. We analyze the UK data to identify alternative configurations. Four system configurations are identified: project-based; mass customization; cellular; and organic-technical. Each has a different combination of organization, processes, tools and systems which offer different performance advantages. The results provide an opportunity for updating the typologies of operations and adapting them to include services, and begin to challenge the notion of any universal 'best practice' management or organization of new product or service development.

INTRODUCTION

We know a great deal about the organization and management of new product development in the manufacturing sectors, but we know comparatively little about how applicable this is to the service sector (Miles, 2000; Tidd *et al*, 2001;Tidd, 2002). In this paper we identify product development practices that explain variation in performance in a sample of 38 service firms in the UK. These practices, which were derived from good management practice from manufacturing, were found to explain significant variance in performance indicators in the UK sample, a matching one in the USA of 70 firms, and a dataset combining the two (Hull and Tidd, 2001). However, scales measuring sets of 'best management practices' constructed from the combined data better fit the USA than UK sample. Therefore, this paper builds new scales from analysis from only the UK data. The objective is to see if some configurations of practice better predict performance outcomes in the UK data than the model of 'best practice' based principally on the USA data.

A typology of organization design is developed to classify the configurations observed in the UK data. The typology provides a theoretical context for hypothesizing which kinds of configurations are likely to have effects on which kind of performance outcome. Using the typology to classify these service data is challenging because contingency theory and the related notion of configurations were derived largely from industrial studies conducted prior to the emergence of large service firms and recent advances in information technology. Our study provides an opportunity to update and extend the notions of contingency and configuration to include service operations.

THEORETICAL FRAMEWORK

The dominant management research and literature on new product and service development seeks to identify and to promote the notion of 'best practice' management and organization (e.g. Clark and Wheelwright, 1993; Cooper and Edgett, 1999). In contrast, the notion that different types of organizational structures and management processes are appropriate for different kinds of tasks dates back to the pioneering work of Burns and Stalker (1961) and Woodward (1965), and the development of contingency theory. Central to contingency theory is the concept that no single organizational structure is effective in all circumstances, and that instead there is an optimal organizational structure that best fits a given contingency, such as size, strategy, task uncertainty or technology (Donaldson, 1996). Therefore the better the fit between organization and contingency, the higher the organizational performance (Drazin & Van de Ven, 1985; Donaldson, 1999). This relationship between contingency, structure and performance has been supported by a substantial body of research conducted in the 1960s and 1970s, including qualitative comparative case studies (Burns and Stalker, 1961; Chandler, 1966) and quantitative analysis of large samples (Lawrence and Lorsch, 1967; Child, 1972). According to a large number of seminal studies, three contingencies appear to be associated consistently with organizational structure: size, technology and task uncertainty.

Much of the early research examined the relationship between formalization, specialization and firm size, the Aston Group (Pugh *et al*, 1969; Pugh & Hickson, 1976) being the most influential work on this subject. Woodward (1965) identified technology as a contingency, and discovered a relationship between production technology, organizational structure and performance. However, Woodward's operationalization of technology was relatively crude, based simply on the flexibility and scale of production processes, whereas Perrow (1970) developed a finer grain typology of technology, based on task analyzability and variability. Similarly, Lawrence and Lorsch (1967) proposed that the rate of environmental change affected the need differentiation and integration within an organization, and found support for this in their comparative study of organizational structures in three different sectors. Galbraith (1977) argued that as task uncertainty increases, more information must be processed, which in turn influences the control and communication structures. More recently, management researchers such as Mintzberg (1979;1983; 1994) and Galbraith (1994; Galbraith and Lawler, 1993) have developed these ideas into more prescriptive management frameworks, which attempt to match organizational structural templates to specific task environments.

The basis of these theoretical typologies and empirical taxonomies is similar. The dichotomy of the "mechanistic" bureaucracy and the "organic" type of organization design of Burns and Stalker is fundamental. Activities that are unpredictable or uncertain require relatively more interpersonal methods of coordination and control than mechanistic-bureaucratic methods. Organic designs are best for innovation, mechanistic ones for cost efficiency (Hull and Hage, 1982; Hull, 1988). The organic type is optimal for competition in complex, dynamic environments; the mechanistic is optimal for stable, predictable environments (Lawrence and Lorsch, 1967). A review of 21 innovation research projects concludes 'environmental uncertainty influences both the magnitude and the nature of innovation…(which) suggests that future research should adopt environmentally sensitive theories of organizational innovation by explicitly controlling for the degree and the nature of environmental uncertainty' (Damanpour, 1996). In particular, perceptions of environmental uncertainty appear to affect the organization and management of new product development (Hauptman and Hirji, 1999; Souder *et al*, 1998; Tidd and Bodley, 2001).

Contingency theory is strongly positivist, and has been much criticized, as it appears to leave little scope for other influences, such as managerial choice or institutional pressures (Powell & DiMaggio, 1991; Tidd, 2001). However, Child (1972) offers some accommodation of the competing theories by allowing some 'strategic choice' within boundaries determined by contingencies, an approach developed by Chandler (1990). A significant body of research on the environment-strategy and strategy-structure linkages supports this view (Dess *et al*, 1993; Miller, 1996). Specifically, the notion of a 'configuration', which is an internally consistent combination of strategy, organization and technology that provide superior performance in a given environment. For example, the success of the multidivisional structure, or M-form, is associated with a strategy of diversification into related product areas, because the volume and complexity of information strains the traditional functional structure (Chandler, 1966; 1990). Most recently, a number of studies have begun to challenge the notion of a single 'best practice' and have re-examined the relationships between strategy, organizational structure and management processes (Thomas and Ramaswamy, 1996; Atuahene-Gima and Ko, 2001; Kald *et al*, 2001). We adopt a similar position here, and argue that contingencies influence the strategic configuration of management, organization and technology, but that they constrain rather than fully determine 'best practice' (Tidd, 2001; Tidd *et al*, 2001), what we have referred to as 'strategic degrees of freedom' (Tidd, 1993).

Much of the best-practice new product development today has been derived from the "lean" approach to product development (Womack and Jones, 1996), based entirely on practices in the manufacturing sector, principally the car industry. From these and other studies ee have distilled an operating core of good practices in new product development, which we refer to as OPTS (Organization, Process, Tools and Systems). Each OPTS construct plays a different role in performance improvement. Organization provides coordination of people; process provides flexible controls; tools provides transformation / transaction capabilities. Cross-functional teams embody an organic alternative to control by bureaucratic hierarchy. Rigid bureaucratic rules are replaced by flexible, enabling processes (Adler and Boryn, 1996). Hard automation is replaced by soft, programmable automation (Collins *et al*., 1996). The integration of the benefits of OPT constructs is hypothesized as resulting in an emergent property system. Concurrent systems are characterized by "reciprocal integration" (Thompson, 1967), which means that work performed by multiple functions along value chains are in a constant state of mutual adjustment as compared with pooled or sequential integration (Liker *et al*., 1999; Hull, 2001). Systems characterized by reciprocal balance among its constructs are presumed to be more capable of achieving a portfolio of competitive advantages, such as both product differentiation and low cost simultaneously. We test this OPTS model against new service development and delivery in the UK and USA.

RESEARCH METHODS

Samples

UK sample. Respondents were drawn from a network of contacts of the School of Management at Imperial College, London. A workshop was held at Imperial College to generate support from these constituents. Although the sample is one of convenience, the network of Imperial College includes links with most types of service company in the greater London area. A hundred questionnaires were sent, and after a reminder 38 usable questionnaires were completed and returned. The preferred respondent was someone in the service product development function, but respondents also included staff responsible for TQM (Total Quality Management), BPR (Business Process Reengineering), and performance improvement. The sample is not random or representative, but does not need to be as we are concerned with associations between service management, organization and performance, rather than a simple survey of practices used. Strictly speaking, the UK and USA samples were not matched, but in practice similar businesses were represented in each sample, with the exception of construction and services rendered by divisions of industrial firms, such as financial credit groups (see Appendix A).

USA Sample. From a list of the largest employers in Crain's New York Directory, 120 service companies were identified for mailing questionnaires to. Respondents from 70 businesses in 51 corporations returned questionnaires. Most major categories in the service sector were represented except advertising and broadcasting. With such exceptions, survey respondents appear to be reasonably representative of large service companies in the New York area and its diversity, especially in financial services.

Analysis Procedures

The scales were constructed using factor analyses only of the UK data (Varimax method). The sets of practice items included in each scale are shown in Appendix B along with Alpha coefficients. The analyses were from all measures within each of the OPTS categories because the items were captioned under these rubrics. Factor loadings and Alphas for the USA and combined samples are available (Hull and Tidd, 2001).

Multiple regression analysis is used to predict variation in performance measures. The step-wise method was used to maximize variance explained.

Measures

The measures were adapted from a 200-page inventory of industrial best practices based on 16 case studies and analysis of 100 American companies (Hull *et al*., 1996). Many of the items had to be reconstructed at a more abstract, general level because of the intangibility and diversity of service products.

Performance measures. Twelve items loaded in four factors in the UK data. The four scales are labeled: (1) product innovation & quality, (2) improvements in service delivery process, (3) time compression in development & delivery, and (4) cost reduction in development & delivery. The question items included in each scale are shown in Appendix B along with Alpha coefficients.

Organization measures. Twelve items, loaded in five factors. These five practice-sets were captioned: (1) Partner involvement (2) Project-based management, (3) Cellular grouping, (4) cross-functional collocation, and (5) Customer involvement.

Process measures. Nine items, loaded in three factors. The three practice-sets were captioned:

(1) documentation, (2) customer focus, and (3) standardization.

Tools measures. Nine items, loaded in three factors. The three practice-sets were captioned: (1) Shared technology, (1) Internal technology, and (3) External linkages.

System measures. Nine items loaded in three factors. The three practice-sets were captioned: (1) Holistic voice of customer, (2) Knowledge integration, and (3) Reciprocal integration.

Best practice index, the sum of all 39 items, is calculated to assess the overall relationship between practices and performance outcomes.

RESULTS

Best practice in the UK Sample

The best practices index has a similarly strong correlation with overall performance in both the UK and USA data-sets. However, the 14 practice-sets conform more closely to the best practice paradigm as defined by OPTS in the US than UK data. The sum of best practices is significantly correlated with all indicators of best practice in only the USA data. For the UK sample, the best practices index has a correlation of .68 with the overall performance index (Table 1). This is due to strong relationships with innovation & quality and service delivery comprising 8 of the 12 items in overall performance.

—See Table 1—

Performance indicators are more strongly correlated with one another in the USA than UK data. In the UK data, the best practices index is insignificantly correlated with time compression and cost reduction. Among performance measures, product innovation & quality has insignificantly negative correlations with time compression and cost reduction as shown in Table 1. Time compression and cost reduction are only modestly correlated with one another. Variance system configurations explain in performance outcomes in the two samples is similar except for time compression and cost reduction as shown by comparing the left and right columns in Table 2.

This suggests a contrast between integrated and diverse performance strategies Service companies in the UK sample may pursue niche strategies that do not require simultaneously achieving multiple kinds of performance advantages. Service delivery is modestly correlated with the other performance indicators.

Service companies in the USA sample seem to pursue an integrated strategy by offering multiple kinds of performance benefits simultaneously. Correlations among the practice sets are positive in all but one instance, and significantly so in 82 of 91 instances (not shown in Table). The 14 practice-sets in the OPTS framework load in three factors: Organization & Process (which are highly correlated), Tools, and System (Hull and Tidd, 2001). This result suggests that the USA data conforms closely to the best practice paradigm as defined OPTS (Hull *et al*., 1996; Hull, 1999).

Correlations among practice sets more strongly correlated with one another in the USA than UK data. In the UK sample correlations among the practice sets are positive in all but three instances, and significantly so in 49 of 91 instances. However, variation in the strength of these relationships suggests the possibility of polymorphism.

This contrast suggests greater diversity in structure in the UK data. Service companies in the USA sample seem to pursue a relatively more integrated than diverse strategy and structure. The notion of integrated product strategy is illustrated by RRR (Rapid, Reiterative, Redesign), which focuses on speedily cumulating many innovations by cost effectively reusing knowledge. The strategy of RRR was measured by two items in earlier analyses of these data, “making major changes to existing service products” and “making rapid changes to existing products” (Hull and Tidd, 2001). The lack of a coherent RRR strategy in the UK data suggests that alternative goals may have been chosen.

<u>Identifying system configurations.</u>

First, the four system configurations and the subsystem are entered into multiple regression analysis. System configurations have seven significant main effects. Second, components from configurations excluded from the equations are entered as solo practice-sets. Components added significant amounts of variance explained in two instances. These relationships are depicted in Figure 1.

--See Figure 1—

System configurations and some of their components explain significant amounts of variation in total performance and all four performance sub-scales as shown for the UK data in Table 2 (left column). The greatest amount of variance explained is for total performance, 43 percent. The smallest is for cost reduction, 14 percent.

--See Table 2---

The 14 practice-sets in the OPTS framework load in five factors. Four of these factors included three sets of practices and are considered as potentially viable system configurations. The fifth factor included only two practice-sets and is considered herein as a subsystem. Interestingly, each of these factors includes a different organization practice-set. Each organization set of practices, along with those from other constructs in the framework, was used to caption the types of configuration as follows: (A) Project-based, (B) Mass customization, (C) Cellular, and (D) Organic-technical. The subsystem is captioned, (E) Partnership process because of its interdependence with other companies. Each of the system configurations is described in the next section. Practice-sets in the OPTS framework are linked with system configurations by letters A-E in Appendix B.

Re-analysis of the two data sets from the UK perspective makes for small, but interesting contrasts to earlier analysis based on the best practice OPTS model. The principal difference is that the configuration approach results in 8 percent *more* variance explained in product innovation & quality in the UK, but 8 percent *less* in the USA (Hull and Tidd, 2001). This is because disaggregating system components enables the organic-technical configuration in the

UK to specialize in practices that a lengthy literature associates with innovativeness (Tidd *et al*, 2001). By contrast, practices associated with innovativeness in the USA appear to have been combined with those associated with time compression and cost reduction.

System configurations predicting innovation & quality include both mass customized and cellular in both nations. But the organic-technical is significant only in the UK data and strongly so. This result suggests that this organic form first identified by Burns and Stalker (1961) continues to be a common organizational configuration for innovation in UK services.

Only modest variation is explained in service delivery performance in either sample although the cellular configuration contributes in both. This reveals a gap in the best practices analyzed herein, which focused more on product development than delivery. Delivery processes often comprise a significant proportion of value added by services and are sometimes tantamount to the product itself especially if generation and consumption are simultaneous or interpersonal exchanges are involved (Gronroos, 1990; Lovelock, 1996; Reichheld and Sasser, 1990; Storey and Easingwood, 1999; Zeithaml *et al*., 1990). To be more predictive of overall service performance, future research needs to be more inclusive of delivery process.

All system configurations of practices are significantly lower in the UK data (except for subsystem E, Partnership Process). This contrast suggests a lack of ecological correlation between deployment of system configuration and level of performance across the two nations. One explanation of this seeming contradiction is that system configurations are parsimonious in focusing on a single performance outcome where as companies in the USA are more likely to combine large numbers of practices to simultaneously achieve multiple kinds of performance advantage. The one is narrowly focused on efficiency, the other on effectiveness. The system configuration approach is more parsimonious for focused outcomes; the best practice paradigm approach more integrated for multiple outcomes.

A. Project-based configuration.

The project-based organization has received relatively little attention in mainstream management research, particularly project-based organizations in the service sector (Gann and Salter, 1998; Hobday *et al*, 2000). Configuration A uses project leaders to organize the involvement of everyone early on to reduce hand-offs (O-2), the essence of concurrent product development (Collins and Hull, 2001). Structured processes, such as QFD (Quality Function Deployment), are used for identifying and migrating customer requirements. Processes are mapped and continuously improved (P-2). The system is integrated by the voice of the customer, holistic thinking, and early involvement of the customer in need fulfillment (S1). In terms of the OPTS framework, Configuration A is strong in Organization, Tools, and System constructs. Although no process controls are explicit, this type seems to rely instead on interpersonal feedback and the discipline of technical knowledge. The main gap in configuration A is in tools/technology as none of the measures suggest technological sophistication in either knowledge or machinery.

To the extent Configuration A corresponds with a craft batch category in the typology, it is hypothesized to achieve high levels of service delivery. This hypothesis supported by its significant main effect in multiple regression analysis on service delivery. In addition, the organization component of this configuration has an unanticipated significant main effect on time compression. These effects on performance are consistent with the flexibility of project-base systems, which is desirable in part because Configuration A is the only one having a significant correlation with an index of environmental dynamism (r=.33, not shown in Tables).

For example, Ove Arup is an international engineering consultancy firm which provides planning, designing, engineering and project management services. The business demands the simultaneous achievement of innovative solutions and significant time compression imposed by client and regulatory requirements. Since 1999 the organization has established a wide range of knowledge management initiatives to encourage sharing of know-how and experience across projects. These initiatives range from organizational processes and mechanisms, such as cross-functional communications meetings and skills networks, to technology-based approaches such as the Ovebase database and intranet. To date, the former have been more successful than the latter. For example, a survey of engineers in the firm indicated that in design and problem-solving, discussions with colleagues were rated as being twice as valuable as knowledge databases, and consequently engineers were four times as likely to rely on colleagues. Two primary reasons were cited for this. First, the difficulty of codifying tacit knowledge. Engineering consultancy involves a great deal of tacit knowledge and project experience which is difficult to store and retrieve electronically. Second, the complex engineering and unique environmental context of each project limits the re-use of standardized knowledge and experience.

B. Mass customization configuration.

Configuration B is organized by the involvement of external customers in product development and delivery process decisions (O-5). Standardization is a key factor in controlling the relationship (P-3). Electronic links are used to exchange data with customers and suppliers (T-3).

In terms of the OPTS framework, product development and delivery is organized around customers in Configuration B, a key feature of best practice (Hartley, 1992). Setting standards for projects and products is a key method of process control. Presumably customers help set these standards in conformance with their requirements. The electronic interchange between Configuration B and its customers provides the capability for continuously changing them to adapt to market demand.

To the extent Configuration B corresponds to a mechanistic bureaucracy in the typology, it is hypothesized as achieving high levels cost leadership. This hypothesis is supported by its significant main effect in multiple regression analysis on cost reduction. In addition, this type also has a significant main effect on product innovation & quality that was unanticipated in the typology. One may speculate that mass customization with programmable technologies had improved the capability of mechanistic firms to innovate, especially in services where capital equipment is less limiting. Possibly, the bulk of product innovation decisions originate at the customer's rather than the service provider's location. This speculation is consistent with the fact that Configuration B experienced market demand for customized products that was growing and turbulent more than any other configuration (r=.26, not shown in Tables). To the extent the locus of innovation is external, the operations of Configuration B conforms somewhat more closely to the hypothesis that machine bureaucracies are less capable of indigenous creativity.

For example, in British Gas Trading (BGT) standardized documentation and processes are used as an instrument of management control, and yet many different types of contract exist. Within BGT, there are formal procedures for assessing the financial performance of projects, and all projects over a certain threshold require the business owner to prepare a completion report within 3 months of completion. A project is complete when all physical work is completed, all costs relating to the work have been incurred, and all benefits have been delivered.

C. Cellular Configuration.

Configuration C organizes their people as a cross-trained, co-rewarded group, which reinforces their cellular identity (O-3). Electronic tools are distributed to all and enable cell members to map processes, share best practices, and communicate lessons learned (T-1). Cellular systems are typically rather self-contained which may be one reason companies in this configuration are more likely to value knowledge, share it for achieving a balanced portfolio of performance advantages, and re-use it (S-2).

In terms of the OPTS framework, Configuration C is strong in dimensions of organization, tools, and system integration. Its lack of process is compensated by the fact that tools/technologies may serve as surrogates, e.g., common software for project mapping and process mapping. It is perhaps the most well rounded of the configurations in terms of the OPTS framework. Its strategic focus on achieving a balanced portfolio of competitive advantages is consistent with the goal of best practice.

Configuration C seems to correspond in some respects to a professional bureaucracy. Knowledge is regarded as a paramount competitive advantage garnered from outside the company as well as cultivated within. The extent to which knowledge is professionally based in a way analogous to that held by scientists and engineers in industrial firms is unclear. Perhaps the cellular group holds a kind of knowledge certification capability somewhat analogous to professional standards. For example, its use of tools focuses principally on knowledge management, e.g., distributed databases, templates for process mapping, etc.

To the extent Configuration C corresponds to a professional bureaucracy, it is hypothesized as achieving moderate levels of both innovation and cost leadership. This hypothesis is supported by its modestly significant main effect in multiple regression analysis on product innovation & quality. Although the Cellular configuration as a whole has no significant main effects with cost reduction, its organizational component does. This result provides qualified support for the hypothesized advantages of the type with regard to cost. An advantage of cellular organizations is their self-containment. Although the direct work of cross-trained employees is less efficient from a scientific management perspective of Taylor, cells can be cost effective for the total enterprise because administrative overhead is low.

In addition, Configuration C has significant main effects on both time compression and service delivery. One may speculate that the self-containment of quasi-processionals in the cellular group enables them to delivery more customer focused services more quickly than if external professional bodies were controlling internal activities. In any case, the cellular configuration, along with its organizational component, has more significant main effects than any other type. This result is consistent with the thrust of the typology that professional bureaucracies are capable of multiple kinds of performance.

For example, Cable and Wireless Global Markets (CWGM), a division of the UK telecom operator Cable and Wireless, is a systems integrator and service provider which designs, integrates and operates telecommunications networks for multinational clients. CWGM was established in 1996 to deal with the increasing number of non-standard and highly complex outsourcing projects. The common processes and standards developed by the parent company were found to be inappropriate for this type of business. In contrast to the formal business processes and matrix structure used for simpler management network services, CWGM has adopted a more flexible teaming approach, which includes a 'war room' to help build relationships and promote communication between team members and customers (Davies and Brady, 2000). In this way teams can more easily work closely with customers to develop innovative service packages of standardized products and customized applications to achieve the required service level agreements for outsourcing.

D. Organic-technical configuration.

Configuration D is organized by co-located, cross-functional teams in a flattened hierarchy (O-4). Communications are open regardless of rank, both face-to-face and via E-mail (T2). Its technical base utilizes expert systems and management information systems. Responsibility for work is shared and partnering is practiced throughout the value chain (S2).

Many of these practices are core to the definition of the organic-technical type of design (Damanpour, 1991). Organic systems have dense communications facilitated by cross-functional teams and physical collocation (Hull et al., 1996; Collins and Hull, 2001). Cross-functional teaming, whereby different specialists are assigned to work on the same project simultaneously, has been advocated and widely adopted in many companies as a strategy to improve their product development process. Collaboration among diverse functions typically provides better solutions to complex design problems (Gatenby, 1994). Physical co-location involves aggregating project team members in common space. Companies often house cross-functional teams in dedicated space to enhance rich communications among group members (Daft and Lengel, 1986). The scale of operations is either small or managed in such a way that cross-functional teams are collocated with open communications within a reduced hierarchy. Everyone in the value chain accepts reciprocal responsibility for the product.

For example, in BBC Worldwide (BBCW) speed/timeliness is essential to the processes given its strategic nature, and for this reason timelines are prescribed. Processes are strongly time-driven – indeed, diagrammatically they are captured in a timeline. A series of defined steps are involved from the initial receipt of programme treatment to sign-off by a senior management committee seven weeks later. In BBCW, processes are able to evolve reactively to emergent business needs. For example, if a new means of exploiting programmes arises (VOD, broadband video) these additional media would be included in the necessary documentation. In the case of an emergency item that requires urgent approval, informal contacts are exploited to minimize timescales, which is indicative of flexibility and the use of networking.

Within BBCW, approval thresholds are reviewed regularly to ensure that the company is able to devote appropriate management time to investments that have a significant impact on its businesses. The process facilitates effective and efficient co-ordination of offers, the objective being to increase awareness of programmes and products available for investment; to focus investment strategies; and to co-ordinate offer documents to expedite investment decisions. The process documentation at BBCW has in-built financial measures as well as benchmarks against the success of previous programmes. The quality of a bid is dependent on individuals and departments providing the required information on a timely basis, together with robust ROI analyses and sales projections.

E. Partnership process subsystem

Subsystem E is organized by involvement of external partners/suppliers in product and delivery process decisions (O-1). Processes are documented, checked for conformance, and benchmarked with best-in-class (P-1). This subsystem is similar to Configuration B except that the organizing focus is on partners or suppliers instead of customers and the process method is documentation instead of standardization. In terms of the OPTS framework, subsystem E is weak in specifics of organization, but strong in process control via documentation. No items measuring tools were included. System integration measures were also absent. Companies in this niche achieve either a kind of backward integration toward sources of supply and/or horizontal alliances with partners to provide more holistic services. As such, this subsystem is not viable as a stand-alone enterprise.

Subsystem E has no clear linkage with the typology. As a subsystem, it has no significant main effects in multiple regression analysis. However, one of its components, involvement of partners in service product development and delivery decisions, has a modestly significant main effect on the overall performance index.

DISCUSSION

All four configurations had at least one significant main effect on the specific performance indicator. Examination of the actual measures suggests that each of the four system configurations provided several common elements, including:

- Organizational mode of bringing people together;
- Control mechanisms, either impersonal (standards, documentation, common software) or interpersonal (collocated teams);
- Shared knowledge and/or technical information base;
- External linkages, e.g., customers and/or partners/suppliers.

Each configuration appears to have parsimoniously evolved or acquired sufficient good practices to be viable at least in niche markets. The viability of these configurations in the UK data argues for updating the standard contingency typologies to encompass advances in technology and making such typologies more generic to better accommodate service as well as manufacturing sectors.

A trend that seems to apply to all the systems in the typology is the devolution of business responsibility. The project-based configuration and the cellular are conspicuous additions to the organic-technical type. Mass customization also implies some degree of devolution in that highly centralized decisions about large volumes of standard items build for inventory are no longer the only option. This trend is also illustrated by partnership process subsystems that such a have narrow scope of responsibility they are viable only in alliance with others. In sum, the general trend toward smaller, more decentralized units suggests significant changes in the structure and operations of all the configurations in the typology and fragmentary subsystems.

The traditional notion of the craft/batch organization needs rethinking in light of the project-based organization. Although lacking in tools, the project-based configuration was rather sophisticated in organization and process. For example, its organization involved downstream functions early on. The processes deployed by Configuration A to incorporate the voice of the customer in their products were advanced, e.g., QFD (Quality Function Deployment). This is consistent with the fact that Configuration A made more use of TQM (Total Quality Management) and BPR (Business Process Reengineering) than any other. (r=.39 and .53 respectively, not shown in Tables). Both goods and service companies increasingly deploy project-based organizations to integrate resources more quickly to serve their customers (Gann and Salter, 1998). In sum, companies in this niche may compensate for a lack of advanced technology with prowess in organizational and process. Moreover, their lack of advanced technology is relatively less important for adding value in services than in goods industries.

The mass customized configuration differs from a traditional machine bureaucracy in two important ways. First, the limitations of dedicated assembly-line equipment during the period when Woodward's mass production type was first described have been largely surmounted by flexible, programmable automation (Collins *et al*., 1996). Second, the openness of Configuration B to customers contrasts with the closed systems of yesteryear that produced large quantities of standard units to stock (Mintzberg, 1979). Its programmable capabilities enable a degree of mass customization that was impractical in earlier era of dedicated equipment for specialized production. This has enabled mass producers to customize products more easily and respond to the voice of customers in new ways.

Professional bureaucracies have often been burdened by conflicting masters, the knowledge-based codes of professional conduct and large-scale administrative requirements. However, the growing volume and specialization of knowledge challenges the boundaries of traditional professions and has weakened external control over internal activities within corporations. A growing number of loosely regulated communities of practice have emerged both within and across different subject-based disciplines. The Cellular configuration enables a relatively self-contained group of people to become experts in developing and delivering products as quasi professionals. Cellular organizations thereby get some of the advantages of codified knowledge with far less hierarchical control by bureaucracy.

An organic organizational design originally meant little more than the absence of bureaucratic constraints. Today the organic-technical type of configuration has a more active agenda. Relatively more influence and resources are given to project teams instead of functional departments. Open communications are not left to chance encounters, but structured by collocated, cross-functional teams deployed in flat hierarchies so that communications are more horizontal than vertical.

Partnership process subsystems are increasingly important because of the vertical disintegration of large corporations into smaller units that no longer have end-to-end responsibility for their value chain. Many kinds of subsystem have evolved with the growth of alliances, partnerships, joint ventures, and electronic networks during the past quarter century. They have core competencies that are viable only in symbiotic relationships (Tidd, 1995). To the extent customers want integrated solutions, many service companies may increasingly emulate industrial practices by building more extensive supply-chain relationships. Subsystems such as Type E may possibly be in ascendancy even thought they are more difficult to capture in classic typologies of system design.

These contrasting approaches to performance may provide opportunities for service enterprises in each nation to learn from one another. Some USA service enterprises might modify the somewhat monolithic best-practice paradigm by emphasizing selected practices from system configurations. For example, they might more fully implement practices associated with the organic-technical configuration to achieve higher levels of innovation. A similar adaptation of the then best practice Fordist paradigm was required when Toyota adapted this to local requirements and changing product markets (Tidd and Fujimoto, 1985). Alternatively, UK service enterprises might need to place more emphasis on integrated strategies that focus on time and cost as well as innovation to compete in global markets. One possibility that this may be occurring is the fact that unlike OPTS constructs, the score for the RRR strategy is almost as high in the UK as the USA data (Hull and Tidd, 2001) and may be a harbinger of subsequent structural changes. In any case, local configurations can continue to provide niche advantages in local markets for a long time, as Souitaris (2001) has demonstrated in the case of innovation strategies in Greece. In the case of services in the UK, many services are not internationally traded or subject to international competition (Krugman, 1997; Turner, 2001), which may make the configurations sustainable for some time to come. Nevertheless, in the longer term, this Balkanized approach to the adoption of best practices in services may prove sub-optimal to the extent markets for services in UK markets become more global.

SUMMARY AND CONCLUSION

The best practice model of new product development as defined by the OPTS framework has applicability in the service sector in both nations. However, USA firms conform more to the model than those in the UK. The four system configurations identified and described above seem to fit the UK data better than the complete OPTS framework. The four configurations feature different combinations of components of the OPTS model, and appear to confer performance advantages in different environmental contexts.

Limitations of the study include heterogeneity in the sample, which is partly due to the diversity of the service sector. Although the nature of the service rendered was not found to affect results much in the USA data (Hull, 1999), this remains a possibility because parallel measures were not collected in the UK. Also, the USA companies were larger on average. As size is a strong predictor of structuring, this difference might partly account for lesser coalescence of organization practices in the UK data. Finally, a single respondent in both nations provided the data.

A particular gap in the applying the best practice paradigm derived from industry to services is its weaker capability of explaining service delivery performance. Variance explained in service delivery was approximately half that for product innovation & quality. One reason is because much of the value customers perceive in service product may be closely tied to delivery processes; especially to the extent interpersonal exchanges are involved. More robust models of product development are needed in both nations that include design for service delivery.

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TABLE 1--CORRELATIONS AND DESCRIPTIVE STATISTICS: UK DATA

	PI	PI-1	P-2	PI-3	PI-4	P1	P2	P3	O1	O2	O3	O4	O5	T1	T2	T3	X1	X2	X3	BSF1	BSF2	BSF3	BSF4	BSF5	Fall
PI	1.00	.54	.46	.48	.87	.48	.52	.54	.20	.34	.47	.29	.33	.34	.38	.16	.37	.42	.39	.39	.44	.40	.58	.54	
PI-1	.54	1.00	-.12	-.16	.36	.39	.20	.47	.13	.23	.23	.46	.50	.16	.51	.06	.23	.51	.50	.55	.44	.30	.29	.39	
PI-2	.46	-.12	1.00	.31	.25	.07	.27	-.12	-.08	.40	.46	.06	-.14	.37	-.02	.18	.29	.18	-.12	-.03	-.03	-.01	.40	.43	
PI-3	.48	-.16	.31	1.00	.25	.08	.37	.29	.25	.11	.37	-.06	.17	.04	-.06	.30	-.02	-.19	-.16	-.10	.31	.21	.28	.12	
PI-4	.87	.36	.25	.25	1.00	.48	.39	.42	.20	.15	.26	.15	.25	.27	.23	.04	.28	.29	.38	.27	.31	.40	.40	.37	
P1	.48	.39	.07	.08	.48	1.00	.50	.40	.52	.20	.12	.26	.33	.29	.16	.15	.22	.40	.37	.30	.37	.85	.39	.36	
P2	.52	.20	.27	.37	.39	.50	1.00	.46	.57	.55	.20	.19	.34	.23	.11	.45	.55	.25	.21	.20	.53	.62	.88	.33	
P3	.54	.47	-.12	.29	.42	.40	.46	1.00	.24	.01	-.04	.20	.50	.00	.17	.37	.25	.13	.24	.22	.80	.38	.38	.09	
O1	.20	.13	-.08	.25	.20	.52	.57	.24	1.00	.31	.13	.12	.44	-.14	.03	.32	.04	.05	.10	.10	.43	.89	.36	.02	
O2	.34	.23	.40	.11	.15	.20	.55	.01	.31	1.00	.43	.16	.05	.06	.10	.04	.37	.43	.26	.20	.04	.30	.80	.41	
O3	.47	.23	.46	.37	.26	.12	.20	-.04	.13	.43	1.00	.12	.27	.31	-.11	.02	.16	.35	-.01	-.01	.10	.15	.33	.73	
O4	.29	.46	.06	-.06	.15	.26	.19	.20	.12	.16	.12	1.00	.36	.09	.66	.14	-.08	.54	.49	.84	.29	.24	.21	.36	
O5	.33	.50	-.14	.17	.25	.33	.34	.50	.44	.05	.27	.36	1.00	.09	.22	.45	.32	.31	.25	.32	.82	.46	.35	.31	
T1	.34	.16	.37	.04	.27	.29	.23	.00	-.14	.06	.31	.09	.09	1.00	.13	.16	.13	.48	.09	.12	.10	.10	.23	.78	
T2	.38	.51	-.02	-.06	.23	.16	.11	.17	.03	.10	-.11	.66	.22	.13	1.00	.12	.07	.51	.70	.92	.21	.13	.21	.27	
T3	.16	.06	.18	.30	.04	.15	.45	.37	.32	.04	.02	.14	.45	.16	.12	1.00	.37	.02	.12	.15	.75	.29	.34	.09	
X1	.37	.23	.29	-.02	.28	.22	.55	.25	.04	.37	.16	-.08	.32	.13	.07	.37	1.00	.32	.35	.13	.39	.14	.79	.28	
X2	.42	.51	.18	-.19	.29	.40	.25	.13	.05	.43	.35	.54	.31	.48	.51	.02	.32	1.00	.52	.61	.19	.27	.46	.81	
X3	.39	.50	-.12	-.16	.38	.37	.21	.24	.10	.26	-.01	.49	.25	.09	.70	.12	.35	.52	1.00	.82	.25	.27	.35	.29	
BSF1	.39	.55	-.03	-.10	.27	.30	.20	.22	.10	.20	-.01	.84	.32	.12	.92	.15	.13	.61	.82	1.00	.29	.24	.29	.36	
BSF2	.44	.44	-.03	.31	.31	.37	.53	.80	.43	.04	.10	.29	.82	.10	.21	.75	.39	.19	.25	.29	1.00	.47	.45	.21	
BSF3	.40	.30	-.01	.21	.40	.85	.62	.38	.89	.30	.15	.24	.46	.10	.13	.29	.14	.27	.27	.24	.47	1.00	.44	.24	
BSF4	.58	.29	.40	.28	.40	.39	.88	.38	.36	.80	.33	.21	.35	.23	.21	.34	.79	.46	.35	.29	.45	.44	1.00	.48	
BSF5	.54	.39	.43	.12	.37	.36	.33	.09	.02	.41	.73	.36	.31	.78	.27	.09	.28	.81	.29	.36	.21	.24	.48	1.00	
FALL	.68	.58	.21	.23	.51	.66	.73	.55	.57	.51	.38	.58	.66	.37*	.52	.48	.52	.67	.58	.65	.71	.69	.76	.64	1.00

Mean	2.56	2.86t	2.31	2.26	2.56	2.76	2.47*	2.64*	2.43	2.45*	2.36t	2.63	2.54	2.41	2.73**	2.28t	2.59t	2.65*	2.68*	2.67**	2.49*	2.60*	2.51*	2.48*	2.55*
S.D.	.51	.83	.78	.97	.68	.73	.74	.96	.87	.77	.83	.90	.90	.83	.96	.89	.71	.83	.74	.75	.72	.69	.64	.65	.48
Mean	2.70	3.09	2.20	2.38	2.73	2.89	2.80	2.94	2.35	2.79	2.63	2.82	2.66	2.59	3.30	2.55	2.80	3.00	3.00	3.06	2.72	2.66	2.81	2.75	2.80
S.D.	.74	.71	.98	1.00	.86	.78	.83	.81	.99	.87	.89	.96	.93	.87	.70	.93	.75	.70	.72	.62	.64	.81	.73	.63	.60

Correlations greater than .38 are usually significant at the .01 level, correlations greater than .29 are usually significant at the .05 level

TABLE 2
REGRESSION OF PERFORMANCE MEASURES ON STRUCTURAL CONFIGURATONS

Type		**Performance**		**Innovation & Quality**		**Time Compression**		**Cost Reduction**		**Delivery Delivery**	
		UK	**USA**	**UK**	**USA**	**UK**	**USA**	**UK**	**USA**	**UK**	**USA**
D	**Organic-technical**		.23t	.40**			.28*		.46**		22t
B	**Mass Customization**	.19t	.23*	.29**	30*		.27*	.28*			
E	**Partnership-process**				.19t				.22*		
A	**Project based**	.27*								.27t	
C	**Cellular**	.30*	.28*		.28*	.29*				.28*.	.32*
F-C/P1	*Documentation*	*.19t*		*.19t*							
F-C/O1	*Partner involvement*						*.19t*				
F-D/O2	*Project-based org.*					*.29**					
F-E/O3	*Cellular grouping*							*.31**			
F-E/X2	*Knowledge integration*								*.16t*		
R 2		.50	.43	.42	.46	.23	.39	.19	.39	.22	.26
R 2 Adj.		.43	.41	.37	.43	.19	.36	.14	.36	.18	.24
F Ratio		8.1**	17.0**	8.3**	18.4**	5.3**	13.9**	4.1*	14.2**	4.9**	12.0**

** p=. 01 * p=. 05 t=p.10 (two tailed significance)

APPENDIX C--CORRELATIONS AND DESCRIPTIVE STATISTICS: UK AND USA

	PI	PI-1	PI-2	PI-3	PI-4	F1	F2	F3	F4	F5	FAll
PI	1.0										
	1.0										
PI-1	.54**	1.0									
	.81**	1.0									
PI-2	.46**	-.12	1.0								
	.77**	.71**	1.0								
PI-3	.48**	-.16	.31	1.0							
	.78**	.62**	.62**	1.0							
PI-4	.87**	.36**	.25	.25	1.0						
	.91**	.56**	.51**	.62**	1.0						
F1	.39**	.55**	-.03	-.10	.27*	1.0					
	.60**	.56**	.56**	.61**	.48**	1.0					
F2	.44**	.44**	-.03	.31*	.31*	.29**	1.0				
	.56**	.64**	.61**	.49**	.39**	.62**	1.0				
F3	.40**	.30*	-.01	.21	.40**	.24	.47**	1.0			
	.54**	.58**	.54**	.52**	.39**	.57**	.69**	1.0			
F4	.58**	.29*	.40**	.28*	.40**	.29*	.45**	.44**	1.0		
	.60**	.57**	.52**	.57**	.50**	.73**	.75**	.80**	1.0		
F5	.54**	.39**	.43**	.12	.37*	.36*	.21	.24	.48**	1.0	
	.61**	.61**	.57**	.59**	.50**	.78**	.66**	.64**	.81**	1.0	
Fall	.68**	.58**	.21	.23	.51**	.65**	.71**	.69**	.76**	.64**	1.0
	.66**	.68**	.63**	.64**	.51**	.83**	.85**	.87**	.94**	.88**	1.0
Mean	2.56	2.86	2.31	2.26	2.56	2.67	2.49	2.60	2.51	2.48	2.55
	2.70	3.09	2.20	2.38	2.73	3.06	2.72	2.66	2.81	2.75	2.80
S.D.	.51	.83	.78	.97	.68	.75	.72	.69	.64	.65	.48
	.74	.71	.98	1.00	.86	.62	.64	.81	.73	.63	.60

Appendix A--TYPES OF COMPANIES IN SAMPLES

Category	US	UK
Financial Services	**18**	13
Retail banking	5	1
Credit Card	3	-
Lending	2	2
Private Banking	1	-
Investment Services	7	10
Insurance	8	2
Consulting Services	4	5
Construction	1	-
Distribution/logistics (*)	6	2
Education/training	1	0
Healthcare	**8**	**4**
Diagnostic services	4	2
Hospital	1	1
Pharmaceutical services	2	1
Manufacturing related services (**)	4	-
Non-profit	3	1
Publishing	2	1
Retail	3	2
Travel/Hotel	2	3
Telecommunications	5	2
Transportation	5	3
TOTAL	**70**	**38**

*Utilities, Engineering Services, Distribution of Product, etc.
**Credit, Risk, etc.

Appendix B –MEASURES OF PERFORMANCE AND OPTS FRAMEWORK

	Configu-ration	**UK Alpha**	**US Alpha**
PROCESS		**.81**	**.88**
P1. Documentation	**E**	***.73***	***.70***
a. Benchmarking best-in-class companies			
b. Improving documentation of processes			
c. Measuring conformance with processes			
P2. Customer focus		***.74***	***.78***
d. Using structured processes for identifying customer needs and translating into requirements (QFD)	A		
e. Institutionalizing systematic reviews for development projects			
f. Mapping processes to reduce non-value activities			
g. Institutionalizing continuous improvement processes			
P3. Standardization	**B**	***.62***	***.64***
h. Setting performance criteria for projects			
i. Setting standards for the performance of products			
ORGANIZATION		**.74**	**.95**
O1. Partner Involvement	**E**	***.86***	***.84***
a. Involvement of external partners/ suppliers in decisions about service product development			
b. Involvement of external partners/suppliers in decisions about changes in service delivery processes			
O2. Project-based management	**A**	***.62***	***.85***
c. Strengthening the role of project managers			
d. Increasing the influence of downstream functions in upstream decisions, e.g., customer service input in prod. dev.			
e. Reorganization of jobs to reduce hand-offs			
O3. Cellular grouping	**C**	***.70***	***.69***
f. Cross-training specialists			
g. Rewarding project teams/groups			
O4. Cross-functional collocation	**D**	***.69***	***.74***
h. Cross-functional teaming			
i. Collocation			
j. Flatter hierarchy in the organization chart			
O5. Customer Involvement	**B**	***.69***	***.79***
k. Involvement of customers in decisions about service product development			
l. Involvement of customers in decisions about delivery processes			
TOOLS		**.62**	**.83**
T1. Shared technology	**C**	***.71***	***.80***
a. Distributed databases on-line to multiple functions			
b. Common software for project management			
c. Common software for process mapping			
d. Building on-line databases with lessons learned and best practice templates			
T2. Internal technology	**D**	***.74***	***.65***
e. E-mail			
f. Management Information Systems			
g. Expert Systems			
T3. External linkages:	**B**	***.59***	***.71***
h. Electronic Data Interchange with customers			
i. Electronic data interchange with suppliers			
SYSTEM		**.78**	**.89**
S1. Holistic voice of customer	**A**	***.79***	***.70***
a. Align competing product requirements by focusing on "Voice of the Customer."			
b. Cultivate staff to provide holistic, system-wide thinking as well as specialized knowledge			
c. Involve customers early in the service product development process, pulling the product design in the direction of customer needs			
S2. Knowledge Integration	**C**	***.75***	***.64***
d. Focus on achieving a balanced portfolio of competitive advantages for which customers are willing to pay, e.g., cost with novelty			
e. View knowledge as a paramount competitive advantage to be gained from outside as well as inside the company			
f. Transfer lessons learned from previous activities to succeeding people so that they build upon an existing base to reach ever higher future targets			
S3. Reciprocal Integration	**D**	***.67***	***.67***
g. Involve all functions throughout the development and delivery process with few hand-offs so that every works together reciprocally --sharing responsibility for the service product			
h. Act as a good partner with others, such as suppliers, external service providers, alliance partners and customers, in creating and maintaining mutual win/win scenarios			
i. Open communication channels to all functions and ranks in the organization			
PERFORMANCE IMPROVEMENT		**.77**	**.94**
PI-1. Product innovation & quality		***.88***	***.85***
a. New features			

b. Upgraded features.		
c. Higher quality		
PI-2. Time Compression	***.59***	***.95***
d. Shorter time from concept to test market of service product		
e. Shorter time from test market to full-scale delivery of the service product		
PI-3. Cost Reduction	***.74***	***.87***
f. Reduced cost of service product development		
g. Reduced cost of service product delivery		
PI-4. Service delivery improvement	***.75***	***.91***
h. Shorter response time to order for existing service products		
i. Shorter time for adjustments to complaints		
j. Better after sales support services		
k. Higher quality of delivery process, e.g., fewer customer complaints		
l. Conformance with service product development process and procedures		