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THE PENCIL-LESS ARCHITECT'S OFFICE: A 66DEVIANT" CASE STUDY OF THE DYNAMICS OF STRATEGIC CHANGE AND INFORMATION TECHNOLOGY

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ABSTRACT

The dominant view in the information technology (IT) strategy literature implicitly or explicitly incorporates a normative model of dynamic alignment in which business strategy is seen as the primary driver of strategic adaptation. This paper describes and analyzes a case study of the strategic application of IT where success emerged via a different process. As well as providing evidence of a path to strategic fit that is rarely discussed in the literature, the case points to mastery and the management of risk as critical factors in the process of IT-based strategic change.

1. INTRODUCTION

The strategic management and organization theory literatures have long held that changes in business strategy precede structural adaptation (Chandler 1962; Rumelt 1974; Donaldson 1987), with the latter driving a re-alignment of management processes in the firm (Miles and Snow 1984, 1992). While there has been some debate around the degree of strategic choice (see Child 1972; Bourgeois 1984), the view of business strategy as the primary driver of organizational adaptation has remained the dominant paradigm, in both a descriptive and a normative sense. It is also a perspective which has been adopted, implicitly or explicitly, by researchers into the strategic management of information technology (IT). For example, the widely cited MIT '90s framework (Scott Morton 1991), assumes that a firm's business strategy drives the subsequent alignment and fit of organization structure, management processes, roles and technology. While this IT literature on strategic alignment emphasizes that strategy formulation should take account of the potential IT offers to reconfigure the business (Henderson and Venkatraman 1992; Keen 1991; McFarlan 1984; Wiseman 1985), it has nevertheless tended to adopt the dominant organization theory view about the dynamics of strategic change.

We present a case study of the strategic application of information technology where success emerges via a very different process that is almost the reverse of these conventional, rational models. In this case, rather than beginning with strategy formulation, the process began with a tactical and incremental adoption of technology that became the catalyst for a change of individual roles and skills, followed by structural adaptation, and, later, changes in the firm's management processes, which embedded and reinforced organizational learning. From this new configuration, a business strategy and vision began to emerge as a range of new strategic options became apparent. In this way, the IT strategy and subsequent business transformation gradually evolved out of tactical responses to operational needs. In time, this process came to shape the strategic fit of the firm. Thus the case provides evidence of dynamics quite different to that assumed in much of the IT and more general strategic change literature.

The strategic value of the firm's gradual transformation was not a simple direct consequence of the application of IT but a function of the particular interaction of organizational, individual and technological factors, for which IT was the initial catalyst. This interaction created strategic fit and embedded processes of learning in the firm. Thus this is a case study of organizational adaptation and strategic dynamics (Leonard-Barton 1992), in which IT plays a critical role, rather than a study of diffusion of a technical innovation (Rogers 1983; von Hippel 1988; Cooper and Zmud 1990).

As well as providing evidence of a little-reported dynamic path to strategic fit and highlighting the role of learning, we show how the change process had important implications for the management of risk. The traditional change model revolves around a strategic vision and the implementation of large scale change, which is inherently high risk (Davenport 1993). In contrast here, the change process was characterized by incremental, sequential, independent steps, which minimized threats to the firm by decoupling the risks and spreading them over both different projects and time.

This paper describes and analyzes these issues: a different dynamic path to strategic fit, adaptation via incremental learning, and how risks were minimized in the change process. Of course, generalization from an individual case is obviously limited. Nevertheless, the detailed study of transformation processes at one firm can be useful, especially when, as in this instance, research and theory about IT based strategic change are at a formative stage, and where the research problems are embedded in the particular organizational context and experience of the actors (Benbasat, Goldstein and Mead 1987; Yin 1984; Pettigrew 1989). Case research is particularly suited to the study of information technology management and change because it provides the opportunity to analyze in-depth the complex processes, interactions and interdependencies that characterize the development and implementation of IT-driven change (Lee 1989). The paper begins with a description of how the change process unfolded at Flower and Samios Pty Ltd (formerly Flower and Coutts), followed by an analysis and discussion of the dynamics of strategic fit achieved at the firm.

2. CASE DESCRIPTION

In 1987, Flower and Samios was a small architectural practice in Sydney, Australia's largest city, with sixteen employees and an annual project portfolio worth $20 to 30 million. No computers were used in the business. Within five years, the entire practice had been transformed. By 1992, there were twelve staff, but the annual project portfolio was over $100 million. Drawing boards and pencils were no longer used. Instead, all design work was undertaken on networked Apple Macintosh computers, using a range of integrated CAD and multi-media software packages. This section of the paper describes how the transformation was initiated, how it evolved, and how has it changed the business, both internally in terms of management structure, roles and processes, and externally, in terms of relations with clients, suppliers, and competitors.

While researching the case, we conducted multiple, in-depth interviews with five staff at the firm, including the two senior partners. We also interviewed one staff member who left the firm during the study, both before and after his resignation. In addition, interviews were conducted with two clients of the firm to obtain a customer perspective on the firm's services. All interviews were conducted in person by one of the authors, and varied from 45 minutes to two hours in duration. Typically, interviews were tape recorded and transcribed and provide the basis for the quotations below. In the case of the senior design partner, John Flower, who was the prime mover in the firm's gradual transformation, a number of interviews were conducted, totalling over twelve hours. In addition, to obtain a comparative view of current architectural practice, practices in other architectural firms were examined, and one of the authors attended an industry seminar on IT in architecture, presented by John Flower.

2.1 In the Beginning

Over the years, the senior partner, John Flower had periodically examined the computer systems available to assist with architectural design. However, on each occasion, he had generally been unimpressed by the expense, size and complexity of operation of the systems he saw. The trigger to buy a computer came in 1987, when he lost a design competition to a rival. Inquiring as to why his "terrific" design had not won, he was shown his rival's winning entry — a computerized 3-D "walk-through" of the building design. The presentational contrast was dramatic. As John remarked, "We only had these fluffy little sketches!"

> I came back and said to my partner at that time: "That's it — we are getting a computer." So we went and saw these Macs that a guy had, and I said "show me how to draw a line," and he went "*click — click.*' ' That, basically, was the start of it. We were very nervous, because our whole world had been pencils. We bought a Mac II and a little Mac SE and some basic programs.

From this hesitant beginning, and as they gained mastery of the range of design functions and capabilities, Flower and Samios gradually expanded their involvement with computers until their IT investment reached more than $20,000 per employee. Within a few years, the firm's technology platform had become integral to their professional and business success.

2.2 Evolution of IT Strategy

Three main elements can now be identified as central in the evolution of what became Flower and Samios' IT strategy, although it would be misleading to imply that they reflected

a consciously planned strategy. First, the principal partners agreed that they would learn the new systems. This was essentially a tactical rather than a strategic decision. John Flower was determined not to repeat what he saw as the mistake of a colleague elsewhere, who was "held to ransom" by a CAD computer operator who had become indispensable due to his specialized knowledge. Second, with experience and increasing mastery over the new technology, John Flower realized that there were cost and productivity benefits to be gained from the investment in IT. However, he came to recognize that these could only be captured if the technology became integral to many aspects of the business, rather than being marginalized and used for presentations. This required continuing mastery of the systems by the senior partners and the dissemination of that mastery within the practice. This was achieved on a project-by-project basis, with a staff member being given a computer at the commencement of a particular job, who learned to use the system along with relevant software packages, with help from other staff members who had already mastered these. John Flower explained:

> Everything was job-based, so we only did it on the basis of "Here's a new job, its your turn to start on the machine, and we don't want you using the drawing board at all." Each time that happened, we bought a new computer, and the cost of the acquisition was added to the office cost for that commission. The learning time was also added to the job costs. This extends the changeover time but reduces the risk. Once all of the work stations were established a file server was added to the network, with the network itself being established after the third station was installed.

By means of this procedure, and the insistence that staff "put down their pencils" and master the systems, learning was disseminated throughout the firm. Proceeding gradually, with IT investment costs spread across projects, meant that the investment did not involve large, high risk bets for the small firm. In addition, with costs absorbed within the overheads for each project, the demands on scarce capital were contained.

The third important component was the decision to use only proven, "off-the-shelf" hardware and software systems, that were relatively easy to learn and easy to use without reliance on technical specialists. This was, in fact, critical to the achievement of the first two elements presented above. It was only the availability of such systems that enabled the firm to leverage their business, allowing this technology to become central to the firm's core business processes, without the firm becoming dependent upon a technology they could not understand or operate. In this way, first professional needs and then business needs always predominated in decisions about technology. While the technology became the engine of the business, the business professionals remained firmly in the driver's seat. As John Flower noted "we are computer-aided architects, not CAD operators." With the benefits of accumulated experience with the software and hardware, staff began to utilize their capabilities more extensively and developed skills in moving between packages and integrating particular software components when working on designs and design presentations.

The availability of relatively low-cost, high-powered personal computers, with sophisticated graphically-based operating systems and software, significantly lowered the risks of the change process for the firm, as did the commitment to mastery of the systems at all levels of the business. This combination of a simple, yet sophisticated, technology platform with continual learning and mastery across the firm has been a critical part of Flower and Samios' business and professional success.

2.3 How Has IT Changed the Business?

In effect, Flower and Samios have, over a period of time, used technology to redesign their business processes (Davenport and Short, 1990; Hammer, 1990; Davenport, 1993). Internal task and management processes have been transformed, providing increased capacity to focus on customer service. Extensive experience with the new technologies has led to greater familiarity with complex design tasks, ease of use, and greater responsiveness to client needs. The combined effect of the changes has reshaped the firm's strategic position to give them an apparently sustainable competitive advantage in their industry. Flower and Samios have increased their business by 400% over the period 1987 to 1992, during a time when local architecture firms have been experiencing a severe recession, with a significant proportion of architects in Sydney being out of work.

Tasks: The design task is simplified to become faster, more flexible, and more reliable. It is *faster* because the powerful CAD systems contain within them much automated specialist knowledge. For example, John Flower commented that, in ninety minutes, he could design a complicated roof that an architect who specializes in these takes almost a week to complete because of the time involved in calculating the complex geometry and completing the drawing. In addition, CAD systems allow a number of alternative design ideas to be tested quickly. One of the staff members at Flower and Samios commented that initially he was quite skeptical about the supposed productivity benefits of the system: "I thought it was quicker to do manual drawings, but after a few weeks,

I was much faster on the computer." The design task is more *flexible* because it allows for easy amendments and variations, as well as storage and re-use of design components. It is more *reliable* because the system automatically ensures that the geometric and other calculations are accurate. Materials quantities and costs can also be accurately estimated from the design itself by the software program and are automatically updated as designs are amended.

Customers: Flower and Samios had always been client-focused. However, innovative use of IT has enhanced their ability to service their customers by increasing the flexibility of customization, reducing time to completion, and improving the range of value-added customer services the firm can offer. These have been achieved with presentation technology that maximizes client understanding of particular design functions and alternatives, facilitating meaningful and direct client involvement and feedback on the design process. This leads to considerable increases in customer satisfaction at relatively low cost.

As developments such as multimedia integration occur, the firm has been able to adapt and utilize these advances to improve client service. For example, a "movie" of a new design in its planned location can be presented on screen, utilizing scanned photographic or video images of the site, integrated with 3-D images of the planned development. Internal "walkthroughs" of the buildings, with light, shadows and views accurately simulated for the actual site, provide the client with an easily understood and far more detailed picture of the consequences of the design than is possible with usual two dimensional images of architectural sketches. The firm thus uses and integrates video capturing, photo-realistic rendering and photo montaging in its computer-based design presentations. This ease of demonstration has also meant that the firm is well placed to meet the increasing local government council requirements for community participation and comment on proposed developments. This can be achieved by projecting such 3-D "movies" of the design-in-location on large video screens in public meetings, which helps interested parties to gain a clearer picture of the proposed outcome. The associated business benefit from this is that the greater clarity and improved communication reduces controversy and conflict and lessens the risk of expensive litigation in the Land and Environment Court. As one major client who had been through the community participation process commented, "John's presentation to the public meeting was sensational. People can't read plans, so this made it much easier for them to understand, and they were thus less fearful and antagonistic. It was also easier to answer their questions."

Another example of the contribution of IT to the firm's client responsiveness is the capacity to provide property developers with a real-time assessment of the capacity and income potential of a proposed site through the use of basic site modelling and block modelling on the computer system. This enables a developer to make more profitable investment decisions about proposed sites by gaining a clearer initial picture of the site options. Speed of the full design process also minimizes interest and site holding costs for property developers because time to market is reduced.

Suppliers: Communication with external specialists is increasingly electronic. Instead of passing reams of large, detailed paper plans between offices, computer disks are exchanged with quantity surveyors, structural engineering specialists, and photographic or publishing shops. Communication by modem is also now an option. This significantly reduces inter-organizational errors, communication costs and response time. Operationally, it has many of the characteristics of a just-in-time system among a network of professional service firms.

The close relationships that Flower and Samios have established with hardware and software suppliers means that they are kept well informed of new developments and are even considered a partner in trailing new ways of working with the technology by some specialized software development houses. Periodically they will hold internal workshops to share their learning, in which the technology suppliers often participate. This reinforces and sustains their prime mover position.

Individuals and roles: Dramatic changes to traditional architectural and drafting roles, in relation to the transition from pencils and drawing boards to computer screens and mouse technology, have been mentioned above. These changes have meant that one person can now take responsibility for a greater proportion of a project, using the computer to design, detail, estimate and schedule the project, with less dependence on draftspersons and external specialists. In terms of staffing policy, Flower and Samios have also moved away from the conventional architectural model, whereby students, new graduates and specialist draftspersons were employed to undertake various tasks in the design process. Now, they only employ people who are experienced architects and train them to use the computer technology. This staffing policy has potentially important implications for the profession that are discussed later in the paper.

Just how integral the IT platform is to the work of the firm, and how the roles have changed, was illustrated by a staff appointment. While the individual was a competent architect, he found it difficult to move away from his traditional skill base. Essentially, he was unwilling to surrender his

traditional bases of expertise — skill at creating design sketches on paper and the speed and quality of his draftsmanship — and to invest the necessary effort to master the computer systems. He commented that, while CAD technology had a useful role to play, he believed it should not dominate the architectural process: "It is easier to do the early, rough conceptual sketches on paper, and then use CAD to formalize it later, to get all the dimensions and documentation right. The broad-brush, creative side of the process is more suited to rough hand sketches." By this stage in the evolution of the practice's IT strategy, the firm's partners required the development of mastery of the technology in all staff. Because of his misfit with Flower and Samios' commitment to a fully IT-based practice, the new appointee left the firm after a few months.

Competitors: The centrality of IT to Flower and Samios' operations is quite distinctive within the architecture profession in Australia. It is undoubtedly one of the reasons they have been able to grow, even during economic recession. Field research and anecdotal evidence suggest that within the industry, IT is seen primarily as CAD, or a means for automating some existing work. Most of the large practices have substantial, often mainframe-based, IT systems, typically operated as a separate department with CAD specialists. Alternatively, one or two more junior staff are given the CAD systems to learn, and are then used as technicians. For example, when walking around a large architecture firm with one of its senior partners, one of the authors asked him how a particular system worked. The partner did not know and called on a junior designer to give a demonstration. This behavior ensures that organizational learning and experience with the systems remains limited, the technology is marginalized, and its strategic opportunities are not realized.

This was reinforced at a recent architect's association seminar on IT presented by John Flower and attended by one of the authors. Over eighty professionals participated in the seminar, including partners from a number of major architecture firms, and the presentation generated many questions and considerable audience involvement. However, the questions were essentially tactical, rather than strategic ("Can you automate?" rather than "How does this change our business?"). Discussion at the seminar suggested that the understanding most architects have of the application of IT in the industry is at the "automate" stage. However, Flower and Samios' incorporation of IT into their business has evolved well beyond this to the "transformation" stage. For instance, a couple of architects the authors spoke to made comments such as "we've got computers, but we can't do what John does with his." For Flower and Samios, the technology has become integral to all of their fundamental business processes and a key component of an organizational configuration in which all elements are in tight strategic fit.

In addition, many architects appear to be resisting changing their traditional work practices and remain attached to the image of the architect as an artist, who sketches a design in pencil and hands it over to draftspeople to complete the formal drawings. Some believe that using a computer, with its straight lines and fixed measurements, somehow reduces the creativity of the architect. John Flower commented that:

> There is a lot of resistance to this stuff in our industry: "We are artistic and creative, we don't get held to ransom by machines" — a lot of that....Most of our competitors are quite senior in the business....they are well established firms who have got enormous credentials and really aren't interested in computers. They have come from another time, and they really see no need to change.

3. DYNAMICS OF STRATEGIC FIT

It is instructive to consider how Flower and Samios' competitive advantage evolved, in order to understand the dynamics by which strategic fit was achieved. The potential of IT to support or shape the competitive strategy of an organization is widely argued, advocated and believed (Keen 1991; McFarlan 1984; Wiseman 1985), and just as widely recognized as difficult to translate into reality (Chew, Leonard-Barton and Bohm 1991; Kemerer and Sosa 1991). This firm now clearly exhibits strategic fit: what Miles and Snow (1984, p.15) described as "convergence on a set of core business values — doing what one does best, a lean action-oriented structure that provides opportunities for the full use of people's capabilities at all levels." As they describe it, this *gestalt* within the firm is now so obvious and compelling that complex organizational and managerial demands appear to be simple. This simplicity leads to widespread understanding that reinforces and sustains fit. The structure and key management processes teach staff the appropriate attitudes and behaviors for maintaining focus on strategic requirements (Miles and Snow 1984).

In order to understand how this fit is achieved, we need a dynamic model of strategic change. The most frequently cited model of strategic alignment, adapted from the MIT '90s framework (Scott Morton 1991), is set out in Figure 1. While all elements of the model are shown as interdependent, what is needed is a dynamic model of the process by which this alignment is achieved. Most descriptions of fit

Figure 1. A Model of Strategic Change and Fit (Adapted from Scott Morton 1991)

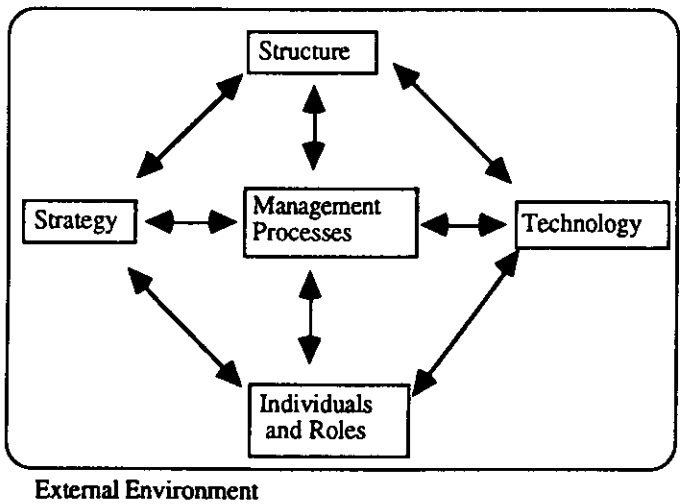
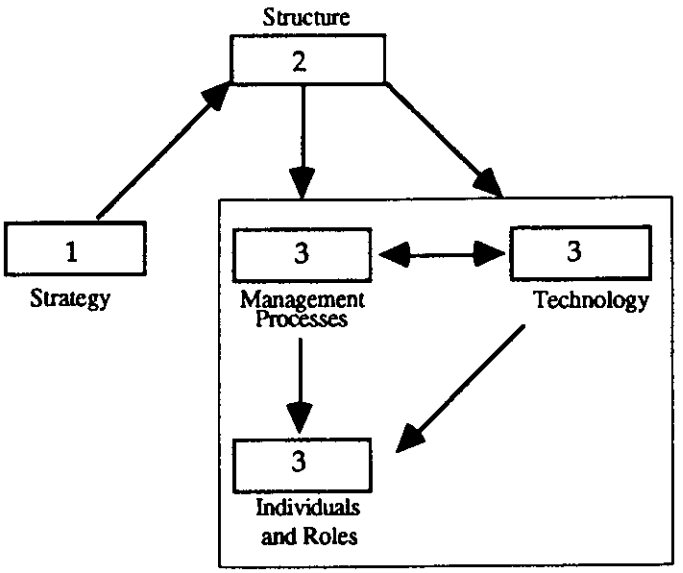


Figure 2. Conventional Model of Strategic Dynamics



in the IT strategy literature tell us little about the path to fit. However, they tend to assume, often implicitly, that this is a world defined and driven by the business strategy of the firm. For instance, Scott Morton (1991, p.20) comments that

> none of the potentially beneficial enabling aspects of IT can take place without clarity of business purpose and a vision of what the organization should become....when the issue at hand is organizational transformation, enabled by technology, it appears particularly important to invest a large amount of time and effort in getting the organization to understand where it is going and why.

This implicit conventional path to fit is shown in Figure 2.

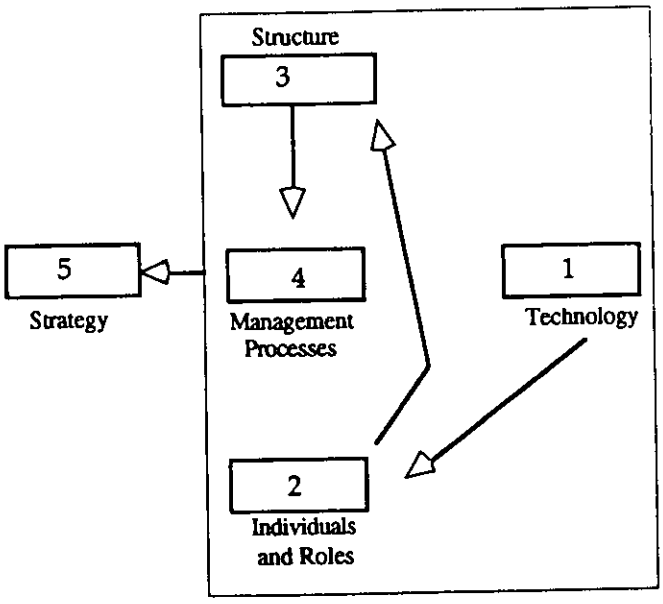
The traditional theoretical argument is that a firm devises the strategy, chooses the structure and management processes that fit it, aligns IT and ensures that individuals are appropriately trained and that roles are well designed (Miles and Snow 1984, 1992; Scott Morton 1991). While for the most part, the organization theory literature is inconclusive about whether this sequence is descriptive or normative, the IT strategic change literature takes a normative approach. However, the sequence we observe in Flower and Samios' progression to fit is not the sequence that is implied or stated in the literature. Their dynamic path can be represented by Figure 3.

Here, in response to a perceived threat, the initial intervention was at the level of *technology*, followed by a transformation of *individual skills and roles*, then changes in *structure*, and the subsequent alignment and integration of *management processes*. The clarification of *strategic* intent, and insights into the strategic drivers of this new configuration, only occurred after the initial organizational gestalt was in place. The strategic vision grew out of the implementation. However, this is not to suggest that, because it does not follow the rational model, this process is somehow inappropriate. In fact, this case may help us to understand the dynamics of fit: suggesting evidence for *how* fit can actually be achieved.

The initial action to implement new technology in Flower and Samios was taken in response to an immediate threat: a design competition was lost, apparently because of the superior design presentation technology of the competitor. Once introduced, the first impact of the technology within the firm was at the level of individual skills and roles: first the partners mastered the systems and then trained the staff on the systems, gradually but comprehensively, on a project by project basis. Importantly, all staff had to master the systems and give up their old drawing skills as they moved onto using the computers. Roles changed to encompass greater scope and one architect could more easily "own" a particular project.

Once fully implemented at the individual level, the structure of the firm was changed to reflect the changing skills and

Figure 3. Strategic Dynamics at Flower and Samios



work practices. The traditional division of labor between architects, draftspersons and student "apprentices" was no longer necessary. Reduced staffing needs meant that cost reductions were realized. With fewer staff and no drawing boards, the structure in effect became flatter, with greater delegation to the more highly skilled staff. In addition, less office space was required. Over time, management and control processes were also adjusted to integrate the work processes. As the number of machines grew, a local area network and a file server were installed to facilitate communication and file transfer within the practice. Materials specifications and costing programs, as well as project management and accounting, and electronic mail began to be utilized within the technology platform.

The awareness of the strategic importance of the firm's experience and skills with the technology platform, and how it opened up opportunities for creating value-added client services, developed out of this initial application and integration of technology into the organization, rather than preceding it. In effect, once the new organizational gestalt was in place, the implicit strategic drivers could be assessed and decisions made as to which of those drivers to make the focus of future developments. Upon analysis, it could be seen that the technology not only enabled lower-cost operations, but more importantly that mastery enabled the creation of competitive advantage through the provision of high quality, timely, and unique customer service. Flower and Samios are now becoming aware of how these value-added services differentiate them from their competitors and form the basis of their distinctive competence.

It could be argued that this scenario is quite consistent with the models in the IT strategy literature that advocate formulating strategy in light of the potential of information technology (Davenport and Short 1990; Keen 1991). However, most of these writers take as given, if not recommend, that the process should be deliberate, planned and logically phased. Venkatraman (1991), for example, writes "an organization cannot just choose to implement, without any planning, a particular piece of technology. Research has shown that it must do so in context, that it must consciously align its business strategy and its organization with its technology." In contrast, the evidence of Flower and Samios suggests that while strategic fit did occur, it was not consciously planned, but emerged out of an incremental, tactical implementation of technology, which in interaction with the organizational factors discussed above, gradually transformed the business. While the literature on the nature of competitive advantage and the role of IT may be used to explain why Flower and Samios have been successful, it does not explain the dynamics of their behavior.

This evidence is consistent with the widespread criticism of rational models of behavior in organizations, including strategy formation (Burgelman 1983; Lindblom 1959; Mintzberg 1991; Quinn 1980; March and Olsen 1976; Weick 1987). When organization change occurs, interpretation of the firm's external environment may be based on real or perceived problems, and will not necessarily reflect market forces or perfect rationality (Fligstein 1985). John Flower was the principal actor in this change process and, as senior partner in a small firm, was in a position to enforce his solution in the organization. He constructed a set of problems that were of particular concern to him personally, worked out a set of solutions that few others in the industry were using, and gave importance to implementing them. The outcome has been a strategic advantage that was not originally envisaged. The dynamic has more resonance with Weick's claim that it is what managers do, not what they plan, that explains their success. Here, strategy is portrayed as an emergent rather than a rational process (Mintzberg 1991), involving small steps that gradually foreclose alternative courses of action and limit what is possible. The case exemplifies Cyert and March's (1963) analysis of organizational decision making under uncertainty, in which it is argued that potentially complex problems get decomposed into a series of tactical, sequential, decisions. At each incremental step, learning occurs, which creates an awareness of different opportunities for action, which in turn affects the next step taken. Thus, it is not rational, planned strategies, but the interplay of small-scale, tactical decision making with ongoing experience that shapes outcomes.

Ciborra (1991) provides a rare example of the application of this type of analysis in the IT strategy literature. He points out how the classic cases of strategic information systems such as Baxter's ASAP, American Airline's SABRE, and France's Minitel gradually evolved from localized responses to particular operational problems or customer needs, rather than being created out of grand strategic designs. Ciborra comments that "incrementalism, muddling through, myopic, and evolutionary decision making processes seem to prevail, even when there is a formal adherence [to rational models of strategy formation]" (p. 285). As we have seen, his comments certainly apply to Flower and Samios. Ciborra also suggests that this incremental and evolutionary organizational learning can form the basis of a sustainable competitive advantage for a firm, where the innovation is embedded in and emerges from a unique set of conditions and experience that is not easily replicated (see also Leonard-Barton 1992). Flower and Samios provide a good example of this. Although the hardware and software are readily available, the successful application of IT in their business emerges from the firm's unique body of learning and experience, and how they have integrated IT into their core business processes.

These views of the evolution of strategic fit differ significantly from the assumptions about dynamics that characterize the general literature on fit, as well as most literature on IT management and strategic change. In particular, rather than being aligned with strategies, structures and management processes, IT is often embedded within the evolution of these very elements. This challenges the notion that the critical issue in managing IT successfully is alignment. The current dominant design in IT is to align the IT strategy and structure with the business strategy and structure (Scott Morton 1991; Henderson and Venkatraman 1992). The word "alignment" itself is widely accepted in the existing literature, and frequently occurs in the title of articles. We would argue that in this, and a limited number of other cases in which we have observed successful organizational transformation, IT is a central component in strategic change, and is embedded in core businesses processes, rather than being "folded around," or aligned with, the prevailing configuration (Yetton and Johnston 1993).

This is not to argue for a "technological imperative" (Markus and Robey 1988) in explaining the change process. Instead, it was only out of the dynamic interaction of individual, organizational, technological and strategic factors that the outcomes emerged as they did for Flower and Samios. Thus, our analysis here is closer to Markus and Robey's "emergent perspective." The difference is that, instead of emphasizing how general social processes and social interactions shape the uses and consequences of IT as Markus and Robey do, we focus on the how the specific business context, management processes, structure, and individual roles and skills, interact with the incremental adoption of technology to shape the strategic intent of the firm in an emergent fashion.

The case is also consistent with calls for mixing levels of analysis in interdisciplinary research, where the phenomena studied inevitably involve multiple levels: individual, organizational and environmental (Markus and Robey 1988; Rousseau 1985). Here, the learning and adaptation occurs initially at the individual level, affecting skills and roles, which leads to structural changes in the firm. Management processes then change to reinforce and institutionalize the new ways of working, with awareness of strategic opportunities generated by the change process developing gradually over time. It is this dynamic interdependence among factors at different levels of analysis that creates the tight fit for the firm. The embedding of the new learning and work practices in management processes again affects the individual level. For example, all new staff are now appointed on the condition that they will master the IT systems. However, one new appointee, who was otherwise very competent, failed to adapt to these different work requirements and subsequently left the firm.

The changes in the firm's staffing requirements could have significant implications for the industry generally, if other firms follow their lead. Flower and Samios no longer employ new architectural graduates. Formerly, graduates were hired to handle the drafting and documentation workload generated by the skilled design professionals. In doing so, they undertook an "apprenticeship" in the firm, being gradually trained in the practical skills of the profession. This was an efficient solution for Flower and Samios, as it allowed the experienced staff to focus on high value-added work. Now, it is considered to be inefficient to employ inexperienced graduates, because the computers have absorbed much of the more mundane work of documentation and drafting. Furthermore, the firm has found that it is less costly for the firm to employ an experienced architect who is willing to work with computers (and many now have had some prior exposure to CAD) than to wait a few years while they bring a new graduate "up to speed" in architectural design. Over time, if this technology becomes central to the core business of many other firms, the profession could confront a real dilemma around how it trains, recruits and develops its new members.

The experience of Flower and Samios also suggests that the management of risk made an important contribution to the effectiveness of the change process. Each step in the creation of their organizational configuration was achieved

incrementally and involved essentially low risk actions, anchored in particular client projects, rather than being dramatic or expensive shifts of focus. Each change implemented was job or project based, and thus closely tied to the customer, rather than being large-scale or driven by fascination with the technology itself. At each stage of the process, no high risk action, which might have jeopardized the transition, was required. The change process, from individual learning, through cost efficiencies, integration, and articulation of the strategy, evolved gradually. Being new to computers meant that the firm had no history of incompatible systems to manage and an integrated platform was "simply" grown by restricting the hardware and software to systems that could communicate easily with each other.

What Flower and Samios effectively achieved was a partitioning of the total risk of the transformation into a series of smaller, manageable risks, so that at any one time, the threat to the business from the change process was low. By spreading risks over time, and dealing with them sequentially, the firm was protected from potentially adverse consequences. Managing the process in this way meant that potential performance variance was always low relative to the financial strength of the firm. The downside of this strategy is that it takes time to implement, but the position of Flower and Samios as prime mover in its field meant that this was not a threat.

The incremental evolution of the strategic fit for Flower and Samios raises the question as to whether the fully configured "fit" solution could be implemented rapidly by a competitor in one major shift, or whether an effective fit has to be "home grown" in a more gradual fashion. We have some doubts about the ability of competitors to emulate the success of Flower and Samios rapidly because of the difficulty of capturing the level of organizational learning and experience that they had built up over time with the technology platform. It is this unique learning and extensive experience base which form the core of Flower and Samios' success and which cannot be easily or quickly replicated (Ciborra 1991; Leonard-Barton 1992). Even if such a strategic transformation were possible, the risks associated with these two paths to fit are obviously very different. Major simultaneous shifts in most or all domains represented in the model (see Figure 1) require large scale transformations which are inherently risky, and often a threat to organizational survival (Hannan and Freeman 1990).

The Flower and Samios case illustrates on a small scale many of the ways in which the innovative use of information technology can transform business processes and create competitive advantage through professional mastery and strategic application of the technology platform. The experience of Flower and Samios in implementing information technology may generalize to other professional organizations. However, it is a small firm and so does not face the range of coordination and control issues that are critical for larger organizations. Nor does it face the same level of system complexity as that faced by many large manufacturing and service organizations. Nevertheless, Flower and Samios is an exemplar case of the successful application of IT, where this application has become an integral part of the strategic focus and managerial processes of the organization. The IT strategy is not "aligned with" the business strategy; it is now an essential component of, and inseparable from, that business strategy. At the same time, the technology systems do not provide any competitive advantage on their own: it is the organizational gestalt in which the technology is embedded, its consistent strategic application, and the focus on learning and mastery within the firm that create competitive advantage.

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