HARNESSING KNOWLEDGE RESOURCES FOR INCREASING RETURNS:
SCALABLE STRUCTURATION AT INFOSYS TECHNOLOGIES*

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Abstract

In post-modern corporations, resources are no longer inert, but knowledge-infused. An implication is that it is possible for a firm to generate new knowledge even as it deploys existing knowledge, a phenomenon that we label as “scalable structuration”. Inducing scalable structuration, however, entails processes that (a) recognize the tacit-explicit dimensions of knowledge, (b) transform private knowledge into accessible collective organizational knowledge, and (c) avoid path-dependencies in knowledge accumulation that result in core rigidities. We explicate these processes through an in-depth analysis of an exemplary firm, Infosys Technologies, which harnesses its dispersed knowledge resources effectively.
Practitioners and researchers increasingly view knowledge as being a strategic resource (Winter, 1987). With rapid advances being made in information-based technologies, we are witnessing nothing short of another industrial revolution – one in which artisans are “using their heads and not their hands” (Fortune, 1991). Echoing the sentiments of a growing number of scholars and practitioners, an article in Business Week (1992) suggested that “competitive advantage no longer belongs to the biggest or those blessed with abundant natural resources or the most capital. In the global economy, knowledge is king”. Although knowledge is now gaining the recognition that it rightfully deserves, it has always played a key role in the functioning of modern firms. Penrose’s (1995) work is illustrative in this regard. She pointed out that a firm is a bundle of resources possessing only an unrealized potential to yield different services. Eventually, it is the firm’s managerial capacity to identify and realize productive services from these resources that yields competitive advantage.

Since Penrose’s time, a key shift has occurred in the nature of resources that firms harness. Specifically, a firm’s productive resources are no longer inert but, instead, infused with knowledge. This shift has profound implications for processes associated with knowledge production and use. Arthur (1991), for instance, pointed out that knowledge-infused resources have properties that are different from traditional resources such as land, labor and financial capital. Rather than diminishing returns that can set in with the use of such traditional resources, knowledge-infused resources have the potential to yield increasing returns. That is, returns from knowledge-infused resources can increase with use, not at a diminishing rate, but at an increasing rate.

It is possible to realize increasing returns from knowledge-infused resources for several reasons. One reason is that the very application of existing knowledge produces new knowledge. Not only do knowledge workers learn to accomplish tasks better (Argote, 1999; Arrow, 1962; Dutton and Thomas, 1985), but they also gain new insights as they deploy existing knowledge (Giddens, 1986; Schon, 1983; Zuboff, 1984). This new knowledge can be reused over time, not only by the creator, but also by others (Alavi and Leidner, 2001). Moreover, such knowledge can be combined with a firm’s accumulated knowledge to yield deeper insights and better ways to function.

The creation of knowledge during the very deployment of knowledge, to us, represents scalable structuration. Structuration captures the duality between structure and action (Barley, 1986; Giddens, 1986; Orlikowski, 1992). In the context of knowledge, structures that emerge are both medium and outcome of action. Specifically, the new knowledge that emerges due to the deployment of existing knowledge has the potential to change the firm’s existing knowledge. It does so not just in a cumulative manner, but in a manner that is transformative. Old and new knowledge vectors combine to transform the
frameworks within which knowledge is created and deployed (Garud and Nayyar, 1994; Kogut and Zander, 1992).

Scalability implies an ability to use the very resources that generate services in the present as platforms for future growth. Using terminology offered by March (1991), scalability represents structures and processes wherein exploration occurs a byproduct of exploitation. Thereby, it reduces considerably the costs that a firm incurs in reconciling once separated forces for exploration with exploitation (Thompson, 1967; Christensen and Raynor, 2003). Indeed, in dynamic environments, the flexibility, speed and scope of operations required of a firm can be accomplished only if a balance can be generated between exploration and exploitation (March, 1991; Brown and Eisenhardt, 1998; Tushman et al, 2004).

How might a firm induce scalable structuration for sustained growth? The processes a firm employs to harness inert resources are clearly inadequate to induce scalable structuration. A different set of organizational structures, systems and processes is required (Galbraith and Kazanjian, 1986). Scalable structuration requires techniques to explore even as one exploits, the incentives and culture to contribute emerging knowledge to a larger collective through codification, sharing and reuse, and the wherewithal to leverage existing knowledge to create a new future. These are the critical elements that must be addressed to design organizations for emergence (Drazin and Sandelands, 1992).

Our paper attempts to identify mechanisms that firms might employ to induce scalable structuration. It begins with a summary of the literature on resources and capabilities. This sets the stage for developing an understanding of the nature of change that post-modern corporations confront. We then highlight possibilities for structuration to occur, first at the point of contact where knowledge resources are deployed, and then at other levels of the firm. To understand what it means to induce scalable structuration, we examine practices followed by one exemplary firm – Infosys Technologies.

HARNESSING KNOWLEDGE RESOURCES

Organizing, at its core, is a knowledge generating and knowledge utilizing activity. March and Simon (1958) argued many years ago that organizations are inherently information processing entities consisting of embedded routines through which information is stored and enacted. Conceptualized this way, organizing involves all of a firm’s systems and structures – in other words, its organizational capabilities.

The importance of organizational capabilities begs the question as to how they emerge in the first place. Penrose’s (1995) work is very useful in this regard. She pointed out that a firm is “...a collection of productive resources the disposal of which between different uses and over time is determined by administrative decision” (Penrose, 1995:24). In other words, resources such as plant, equipment, land and natural resources by themselves, are inert, possessing only an unrealized potential to yield different services. Critical to determining the productive uses to which resources can be deployed is a firm’s
managerial capacity. This managerial capacity involves knowledge not only of the resources themselves, but of the external opportunities they can service.

Penrose suggested that a firm’s managerial capacity set a limit to its growth in any given period. However, this capacity itself changes over time. As managerial capacity is deployed, it expands through experience, and as this happens, “valuable productive services from a firm’s resources will also tend to change” (Penrose, 1995:76). Based on these observations, she concluded that “there is a close connection between the type of knowledge possessed by the personnel of the firm and the services obtainable from its material resources” (1995:76).

This early work spawned research in the resource-based view tradition (Mahoney and Pandian, 1992; Wernerfelt, 1984). Penrose’s description of how managerial capacity emerged through interactions with other resources set the stage for thinking of firms as unique bundles of resources and distinguishing between resource “stocks” and “flows” (Dierickx and Cool, 1989). Subsequent work (e.g., Barney, 1991; Collis and Montgomery, 1997; Petaraf, 1993) has explored what characteristics made resources “valuable” and how firms may leverage these valuable resources to create and sustain competitive advantage.

These developments served as the precursor to research on firm capabilities (cf. Foss and Robertson, 2000). For instance, Metcalfe and James (2000:41) suggested that capabilities are “Penrosian bundles of productive services, derived from resources, and articulated by routines in specific organizational contexts”. The concept of routines is well established in the literature on evolutionary organizational change (cf. Dosi and Marengo, 1994; Nelson and Winter, 1982). Routines are decision rules that provide a template or the instructions for action according to prevailing circumstances. If organizational memory resides in a set of stored action programs, then organizational learning is the continual evolution of these programs in response to environmental constraints and conditions. Scholars have thus been concerned with developing a grammar to describe the nature of organizational routines (e.g., Feldman and Pentland, 2003), understanding the interdependence of routines in complex task situations (e.g., Cohen and Bacdayan, 1994), and adapting routines to environmental variation and change (e.g., Barley, 1986; Levinthal, 1997).

As Metcalfe and James (2000:45) highlighted, it is important for us to distinguish between “those capabilities which generate the current rents and those which develop that rent-earning capacity”. Using the terminology offered by March (1991), one set represents exploitation of the past whereas the other represents an exploration of future possibilities. March pointed out that processes that underlie exploitation are inimical to processes that are required for exploration. Moreover, a firm that is organized to exploit may become trapped by the very resources and capabilities that it is harnessing. That is, the
firm’s core capabilities could become core rigidities (Leonard-Barton, 1992) or competency traps (Levitt and March, 1988).

Recent work has attempted to address this tension. For instance, Lei, Hitt and Bettis (1997) suggested that firms operating in turbulent environments develop dynamic core competences based on meta-learning. Similarly, Teece, Pisano and Sheun (1997: 270) offered the notion of dynamic capabilities as “the subset of the competencies/capabilities which allow the firm to create new products and processes, and respond to changing market circumstances”. In other words, dynamic capabilities and dynamic core competences are concerned with exploration and are very different from the Nelson and Winter (1982) characterization of routines as means for effective exploitation. Subsequently, Eisenhardt and Martin (2000) broadened the concept of dynamic capabilities to include any specific process – not just new product or process development – that allows managers to learn and, in the process, redefine their very resource base. They argued that dynamic capabilities are much more than just routines to learn routines, especially in high velocity environments. More recently, Zollo and Winter (2002) have explored how dynamic capabilities and, in turn, operating routines evolve through experiential learning and the codification of such learning.

**Changing nature of resources**

Even as our understanding of firm resources and capabilities has grown, the nature and functioning of firms themselves have changed. This change has occurred because of the infusion of information technologies into the work place and the emergence of knowledge workers (Zuboff, 1984). Knowledge workers are no longer passive instruments engaging with inert material artifacts. Instead, these workers and the artifacts they use are infused with knowledge.

As Zuboff (1984) pointed out, these knowledge workers can no longer be just “responsible” to someone else. They also have to be “responsive” to the continual flow of information because they are the first to encounter this information and possess the power to utilize or ignore it. After all, the knowledge worker is the “man on the spot” (Hayek, 1945) with local knowledge of the situation.

This shift in viewing firms as bundles of knowledge-infused resources instead of bundles of inert resources is subtle but significant, because it brings with it several important implications. First, the capacity to identify the useful purposes to which these resources can be deployed is endogenized in the resources themselves. Therefore, the knowledge to harness these resources cannot be centralized in a few managers, but must lie distributed (cf. Grant, 1996). As Tsoukas (1996: 22) pointed out, “The key to achieving coordinated action does not so much depend on those ‘higher ups’ collecting more and more knowledge, as on those ‘lower down’ finding more and more way of getting connected and interrelating the knowledge each one has”. Second, it means that these bundles of knowledge-infused resources can combine and recombine in ways that are self expanding, either in a revolutionary or evolutionary manner.
(Garud and Nayyar, 1994; Kogut and Zander, 1992). In other words, the very deployment of knowledge stocks initiates knowledge flows in “continuous wellsprings” (Leonard, 1998).

However, processes required to harness these knowledge-infused resources are different from those used to harness inert resources. Indeed, it would be a mistake to harness knowledge-infused resources with practices that encouraged workers “to do and not to think”, a signature of mass production times (Kanigel, 1997). To the extent that cultural mechanisms and the incentives exist for knowledge workers to be responsive – not just responsible – there is every possibility for the post-modern corporation to realize increasing (Arthur, 1991) rather than diminishing returns.

It is useful to pause here to understand the differences between increasing and diminishing returns. Diminishing returns apply when productivity increases with experience but at a diminishing rate (Argote, 1999; Arrow, 1962; Dutton and Thomas, 1985). Such an experience curve effect is typical of mass production environments wherein deskilled workers learn to perform repetitive tasks. The situation is different with knowledge workers. Clearly, knowledge workers also learn by doing. However, the real value lies in their ability to meaningfully frame the ever increasing volume of information they encounter. In other words, they also learn by reflection (Schon, 1983) to create new knowledge that can yield increasing returns.

To understand this point, it is useful to consider structuration theory as it applies to knowledge (Giddens, 1986). The value of any knowledge is only apparent when it is applied in practice by a knowledge worker who is mindful of local circumstances. In the very act of applying knowledge to a situation at hand, a knowledge worker produces new knowledge. This knowledge is both outcome and medium of action. It is outcome in that the practice-centered application of knowledge results in unique solutions to emergent problems. It is medium in that it adds to the knowledge worker’s framework upon which s/he can draw in the future. As Giddens (1986:144) concluded, “actors are always knowledgeable about the structural framework within which their conduct is carried on, because they draw upon that framework in producing their action at the same time as they reconstitute it through their action” (italics added for emphasis).

Such structurational processes may suggest that scaling up is automatic when we are dealing with knowledge-infused resources. To some extent, this is the case because knowledge-infused resources – unlike inert resources – have the potential to be replenished in use. However, structuration at the individual level does not guarantee scalability at the organizational level.

Before scalable structuration can be realized, several challenges have to be met. One challenge stems from the fact that knowledge has a tacit component to it (Nonaka and Takeuchi, 1995; Polanyi, 1967; Spender, 1996; Tsoukas, 1996). Reuse of knowledge even at the individual level can be compromised if the knowledge that is generated remains tacit. Although a knowledge worker may be able
to draw upon such tacit knowledge in the future, attrition over time can compromise reuse. Explicating such knowledge can help not only in the preservation of knowledge over time, but also in increasing the range of settings within which it can be deployed.

Although explication can result in increasing knowledge reuse at the individual level, such knowledge may still not be fully scalable to the organizational level. First, all knowledge continues to have a tacit component however much it is explicated (Tsoukas, 1996). If its knowledge workers know more than they can articulate (Polanyi, 1967), how might a firm create collective knowledge? For this to occur, it is important for the firm to foster a community of practice (Brown and Duguid, 1991; Lave and Wenger, 1994; Orr, 1990). Creating and maintaining such a community, however, is not an easy task.

A second, but related, reason for difficulties in scaling up individual knowledge to the organizational level has to do with paradoxes associated with the conversion of private to collective goods (Spender, 1996). Issues of ownership and appropriability come into play. Indeed, firms have to ensure that appropriate cultural mechanisms and incentives are present to encourage their knowledge workers to codify and share knowledge with their colleagues. How these issues are addressed becomes central in determining the extent to which scaleable structuration unfolds.

The need for an overall organizational framework for knowledge accumulation presents yet another challenge for scaling up knowledge from the individual to the organizational level. As Loasby (1999:91) pointed out, “All knowledge requires a framework. A viable firm provides a particular set of compatible frameworks within which people can pursue their specialism without the need for continual clarification and negotiation, thus reducing the costs of individual transactions”. Such an overall framework or the collective mind (Weick and Roberts, 1993) provides the “knowledge buckets” (Walsh and Ungson, 1991) within which new knowledge can be accumulated.

However, in addressing this challenge, a firm might inadvertently create another one that arises from the potentially recursive nature of knowledge accumulation (Garud and Rappa, 1994). The recognition of new knowledge requires that one has related prior knowledge (Cohen and Levinthal, 1990; Dougherty, 1992). Consequently, new knowledge may accumulate in a progressive, instead of transformative, manner. Worse, accumulated knowledge produced in action may enable synchronically but constrain diachronically (Giddens, 1986). In other words, the accumulation of knowledge within a framework may become path-dependent (David, 1985), thereby rendering a system vulnerable to competency traps (Levitt and March, 1988) and core rigidities (Leonard-Barton, 1992). For scalable structuration to occur, it is important for a firm to avoid such a contingency.

In sum, structurational processes pertaining to the creation and deployment of knowledge resources are not automatically scalable. They have to be induced by the firm. In inducing scalable structuration, however, a firm faces several challenges. First, it needs to deal with resources that are no
longer inert, but knowledge-infused. This suggests that organizational processes must be able to harness the knowledge that is produced in use, not only for the individuals involved, but for the organization as a whole. These knowledge-infused resources are socially embedded and the firm has to provide a forum for learning and knowledge creation to occur through interaction. Moreover, a firm’s knowledge-base has to accumulate in a manner that is not merely progressive, but also transformative. In the remainder of the paper, we explore how firms may address these challenges by examining how an exemplary firm has induced scalable structuration.

**HOW INFOSYS HARNESSES INTELLECTUAL CAPITAL**

Infosys was founded in 1981 when seven professionals collectively invested $250. By fiscal year 2003, Infosys had grown to employ over 15,000 people and had annual revenues of $750 million and net income after taxes of $195 million (Figure 1). Growing by over 30% annually, Infosys became a darling of the Indian stock market and was the first Indian company to be listed on the NASDAQ in 1999. Infosys is consistently ranked as the most admired company in India and featured by Business Week in its annual Info Tech 100 list. It is also among a select group of companies to have won both the Asian and global Most Admired Knowledge Enterprise (MAKE) awards (see Table 1 for chronology).

A key aspect of growth at Infosys is that the company has had to navigate major shifts in the global IT services market without faltering. For instance, at the beginning of the new millennium, the demand for Y2K-related IT services declined considerably. This decline was followed immediately by the boom and bust years in the dotcom and telecommunications industry sectors, both major consumers of IT services in the world. A second interesting aspect is the company’s reliance on organic growth. Only in 2003 did Infosys make its first and only acquisition of a small Australian IT services company to consolidate its presence in the region’s growing market. This is all the more unique in an era where mergers and acquisitions have driven growth. We explore how Infosys has relied primarily on organic growth to become a global player in the IT services industry, even while navigating such major environmental shifts.

**Building human resources**

Most firms boast beautiful buildings. This is certainly true of the buildings within the campus-like facilities at Infosys’s headquarters near Bangalore, India. But, it would be a mistake to look just at Infosys’s well-designed buildings. As one enters the company’s campus, it is obvious that Infosys is also continually and systematically building its intellectual capital.

This capacity to build is inherent in its employees who are specifically recruited for what Infosys labels as “learnability”. An Infosys word that is both noun and verb, learnability represents the ability of

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1 For a detailed 33-page version of the case on Infosys, please see Garud, Kumaraswamy, Malhotra (2003).
an individual to derive generic conclusions from specific situations and to then apply them to new unstructured situations. Thus, while employees at most firms may be proud of their learning ability, Infoscions are proud of their learnability.

Learnability is much more than routine learning by doing. It includes an ability to reflect in action (Schon, 1983). Infosys’s Director of HR offered a concrete example of learnability and why it is so important:

“The only thing that is constant in our industry is change. If we want our people to cope with change, it does not matter whether they know C++ or Java. More important is whether they are able to figure out how Java is similar to or different from C++ and make appropriate adjustments in applying it. Or, having solved a problem for one customer, can they apply that knowledge in a generic way to some other problem that they face later? This is why we recruit people who possess this generic learning capability that we call learnability”.

Besides helping Infoscions cope with ever-changing technologies, learnability also enables them to cope with the rapid career progression that occurs within Infosys. A new recruit within Infosys is expected to ramp up rapidly from mastering technical skills at age 22 to becoming a manager at age 24 and a “manager of managers” by age 26. By 28, this Infoscion may well expect to become a general manager and by age 32, a director of the company. As the Associate Vice President of Learning and Development pointed out:

“Only those who are able to jump quickly from one paradigm to the next are rewarded. Learnability is key in being able to change and adapt”.

Learnability being the key recruitment criterion, new recruits may not possess the technical or domain knowledge required to complete software development projects. Therefore, after recruitment, Infosys invests considerable effort and time in imparting appropriate content knowledge to its new recruits. This training and education is conducted at Infosys’s Education and Research (E&R) Center. Initially called the “Training Center”, the name of this center was changed to E&R because the term “training” seemed to connote an overly narrow focus on learning by doing instead of encompassing learning by reflection also.

At the E&R Center, new recruits undergo a 14-weeks long educational program which not only provides them with relevant technical and managerial skills but also socializes them into the Infosys culture and value system. Formal education for Infoscions, however, does not stop after this intensive training. Every Infoscion is required to undergo at least fifteen days of formal training every year. Such training includes sessions to upgrade technical and managerial skills and to improve appreciation of quality.

A methodology for exercising learnability
Ensuring that employees have the knowledge and capability to reflect and learn is just one aspect of inducing scalable structuration. A firm also needs a methodology that its employees can use to reflect, learn and create new knowledge. At Infosys, such methods are apparent in an overall framework called the Capability Maturity Model (CMM). Developed by the Software Engineering Institute (SEI) at the Carnegie Mellon University, CMM assesses the maturity level of a software development firm’s processes and methodologies on a scale of 1 to 5. Whereas Level 1 represents just an ability to complete a software development project, Level 5 represents an ability to define consistent processes, measure the efficacy of currently defined processes quantitatively, question these very processes and improve them continually (Jalote, 1999: 6-8). It is telling that Infosys is among the few IT firms in the world to be rated by the SEI at CMM Level 5.

Another way to interpret the maturity level of Infosys’s processes is to consider them as vesting the firm with dynamic capabilities. Specifically, Infosys has used CMM as a framework not just to fine-tune, but also question and change its software development methodologies over time. The Head of the Quality Department explained how Infosys’s software development methodology has changed since the adoption of CMM:

“Way back, we implemented long-term software development projects using what is called a ‘waterfall model’ of development. You got all the requirements and conceived the whole solution upfront and only then did you begin executing the project. We have modified this approach to become more iterative. Especially, with the emergence of e-business, both we and the customer are under intense pressure and everyone wants faster time to market. So, after piloting and evaluating this iterative model in several projects, we formalized it as a completely defined process. But already, we are questioning and modifying this process as we go along”.

This philosophy of iterative and incremental action – one that in our literature would be closest to the notion of logical incrementalism (Quinn, 1978) – is not restricted just to software development, but pervades the entire firm. For instance, this methodology is implicit in the measured implementation process prevalent at Infosys. As Infosys’s COO noted:

“We tend to take small steps in different directions to see what the results will be, before taking big leaps. The philosophy is to take small steps and get feedback for two or three cycles before we scale up”.

**Remaining connected with the external world**

Learnability and CMM are processes at the individual and the organizational levels respectively to ensure that new knowledge is developed even as Infoscions deploy existing knowledge. To ensure that this emerging knowledge base is perpetually connected with the needs of its customers, Infosys insists on establishing close, long-term relationship with its customers. Such close customer relations generate
insights on future trends and also enable Infosys to understand customer needs and preferences even as they emerge.

But Infosys does not rely on this mechanism alone to stay abreast of its dynamic environment. For instance, the E&R Center also emphasizes research and piloting of new technologies. Infosys has also created two entities called the Domain Competency Group (DCG) and Software Engineering and Technologies Laboratory (SETLabs). The DCG, an internal consulting group, keeps track of customers’ industries and also brings together contextual knowledge accumulated by various Infosys units on these industry domains. SETLabs performs applied research in emerging software technologies and development methodologies that Infosys will need to service its clients in the future.

Together, the E&R Center, the DCG and SETLabs play critical roles not just in sensitizing Infosys to external knowledge, but as crucibles within which external knowledge interacts with internally generated knowledge gleaned from various business units. Thereby, they serve as mechanisms to synthesize or recombine such knowledge that, over time, becomes transformative. The efforts of these units were instrumental in Infosys’s smooth transition from Y2K projects to e-business and Internet related projects at the turn of the century. Indeed, within just one year, Infosys increased its share of revenues from e-business and Internet related projects from 1.7% in 1Q1999 to nearly 18.1% in 1Q2000.

Infosys has also set up “proximity centers” and development centers in different geographic locations around the world to mine local knowledge and resources. Besides, Infosys periodically undertakes joint projects with start-up firms and makes minority investments in small firms to track or gain access to cutting-edge technologies.

Harnessing distributed knowledge

To be scalable, a firm needs to leverage knowledge that lies distributed among its employees. To accomplish this objective, Infosys has instituted an integrated approach to knowledge management (KM). According to a member of Infosys’s KM group:

“Our vision is to make every instance of learning within Infosys is available to every employee. We want the collective learning of Infosys to back every person wherever they might be located within the company. Our motto is ‘Learn once, Use anywhere’.” (italics added for emphasis)

Initially, Infosys created a central KM group to develop an architecture for consistent and integrated deployment throughout the firm. Over time, as various business units take ownership of different content areas, the KM group’s role has evolved into that of a cheerleader and facilitator. In other words, the KM initiative is centrally facilitated, yet organizationally distributed (Kochikar, et al, 2002).

Explicating knowledge The origins of Infosys’s KM initiative can be traced to efforts by the E&R Center to create Bodies of Knowledge (BOK). Initiated in 1985, this was an attempt to explicate and
capture experiential knowledge in the form of narratives and formal expositions on topics ranging from software methodologies to adapting to new cultures. However, fewer than 5% of Infoscions contributed to the BOK and fewer still used this knowledge. To address this discrepancy, the KM group redesigned the process to create a “system-imposed demand” wherein knowledge codification and capture would become an integral part of everyday activities. A member of the KM group offered the following example:

“Suppose someone wanted to know how to execute projects for a large utility company using a specific technology. It used to be difficult to get this information. To solve this problem, corporate marketing used to go around meeting people and writing many case studies manually. That was not sustainable. Instead, we figured that we could have a new template wherein the project plan and other documents have brief write-ups on the client and related issues. Then, we can use an automated tool to extract information from these write-ups. This is likely to be much more successful. Now, we are looking at all the processes and documentation to see what we need to change”.

Besides recording internal experiential knowledge in BOK, white papers and repositories of reusable code, the KM initiative also provides Infoscions with access to publicly available knowledge resources such as websites, glossaries of business and technology terms, technology summaries, online journals and books, external reports, and technology and business news.

Sharing knowledge Facilitating the sharing of all this knowledge throughout Infosys is the technology architecture that enables Infoscions to access all content and expertise from their very desktops through an intranet portal called the KShop. This infrastructure enables a culture which encourages sharing. As a Vice President in the Delivery unit pointed out:

“We are a very young organization – the average age of employees is 25-26. Most of our young people are very comfortable with sharing. I can pick up the phone and ask anybody who is not in my business unit to help and he/she will. Within 24 hours, we can get information from anywhere in the world on past projects”.

Indeed, if a question is posted on the electronic bulletin board that is part of KShop, it is typical for several Infoscions from around the globe to respond within minutes.

The KM group also has created an application called the “People Knowledge Map” (PKM). The PKM allows Infoscions to “go public” on their specific expertise so that colleagues may consult them. Thereby, this application allows Infoscions to tap the tacit knowledge possessed by colleagues. Also, it caters to those Infoscions who prefer to listen and learn.

Besides such informal mechanisms, Infosys uses other formal mechanisms to promote knowledge sharing and synthesis. For instance, the rotation of employees among project teams and knowledge domains is one. Cross-functional organization of project or business teams is another. Furthermore, periodic meetings between project leaders or business managers serve as communities of practice for discussing topical issues and best practices with one another.
Re-using knowledge  Apart from enabling employees to codify and share knowledge, an important function of any KM initiative is to encourage reuse of existing knowledge. During the initial stages, Infosys’s KM group realized that the very time pressures that reuse is intended to alleviate also reduced the propensity of Infoscions to reuse knowledge and software code from various KShop repositories. The Head of the E&R Center explained this problem:

“If we create a repository and make it too bulky, the chances of getting useful information actually decrease with time. So, there is this trade-off….Also, we are implementing many shorter life-cycle projects nowadays – 6 weeks to 3 months duration. Suppose someone searches the repository, gets three documents, takes 2 to 3 days to read them and then finds that they are not useful. This is a considerable waste of time. If this happens, this person might question the very utility of the repository and decide not to use it in the future”.

To enable easy retrieval of relevant information, the KM group has adopted a “content architecture”. Each “knowledge asset” in a repository is organized within a “knowledge hierarchy” and tagged by multiple paths through the hierarchy. The KM group has also shifted from an automatic repository-based approach to an integrated approach to maintaining content quality and relevance. Under the new approach, whenever new content is submitted for inclusion, a number of volunteer reviewers offer comments to improve its quality and utility. Then, a centralized group of reviewers streamlines and checks the new content for Intellectual Property (IP) related issues. Only then is it published in a repository.

Addressing the people aspect of KM Even in a culture such as Infosys where sharing is encouraged and embraced, it does not occur automatically. This is because everyday pressures drive employees to complete one project and immediately start another. Also, the rapid pace of change places a premium on learning new technologies instead of pausing to recount or record past experiences. Therefore, even Infosys has to strive to induce knowledge sharing at all levels.

Apparently, it is the people’s aspect – not the technology, process or content – that is an impediment. To address this challenge, the KM group has succeeded in making an employee’s ability to codify and reuse knowledge (as part of project execution and closure) an integral component of his/her performance evaluation. Furthermore, the KM group surveys Infoscions periodically on the extent to which they reuse knowledge and confirms that reported reuse actually occurred. According to an Infoscion:

“As part of CMM and ISO 9000 processes, we have regular audits. During these audits, every person who reports having reused knowledge is asked specific questions on what was reused and how it was reused. No one can get away with just claiming to have reused knowledge a lot”.

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In addition to these system-imposed demands, Infosys’s KM group has also created a stronger link between knowledge sharing/reuse and personal benefit. For instance, the KM group has instituted various rewards, recognition and incentive programs. One innovative incentive is the Knowledge Currency Unit (KCU). Infoscions can earn KCUs for contributing to, reviewing or using knowledge assets in various repositories such as the BOK. They can also earn KCUs every time their contributions are reused. Periodically, they can exchange these KCUs for a variety of rewards such as time off or monetary rewards. In addition to being an incentive to promote sharing, KCUs also serve as a metric to regulate content quality and measure the effectiveness of the KM initiative. Realizing, however, that incentivizing knowledge sharing has the potential to make employees “say more than they know” and also compromise the sharing culture at the company, Infosys’s KM group has progressively modified the incentive scheme to emphasize recognition more than monetary rewards.

**Governing intellectual capital**

In firms such as Infosys, intellectual capital lies distributed among employees who can determine the extent and quality of their intellectual contributions. As Infosys’s Chairman pointed out, the firm’s intellectual assets “walk out of the door every evening” and it is the management’s responsibility to ensure that they return the next morning.

**Distribution of decision rights** In such a context, traditional distinctions between principals and agents begin to blur. Knowledge workers are not merely deskilled agents who are “paid to do and not to think”. Governance processes designed to harness mindlessness in mass production firms can stifle active intellectual engagement of knowledge workers. Infosys’s CFO listed the problems that a traditional bureaucracy generates:

“Size inhibits freedom. Bright, young people want to work in smaller companies. So, Infosys needs to retain the flexibility, speed, collegiality and openness of a small company”.

Infosys attempts to preserve the attributes of a small company by ensuring that decision rights remain with those who possess relevant knowledge – its front-line employees. Such an emphasis has resulted in inverting the traditional hierarchy. People who are at the bottom take decisions based on their knowledge. Underlying such autonomy is the responsibility of using information mindfully to arrive at superior decisions. A founder Director of the company offered the following maxim as a guiding principle for decision making: “In only God we trust. The rest of you bring facts”.

Infoscions are encouraged to challenge one another based on the facts that they can marshal. As a result, Infosys’s culture itself is built around a dialectic tension where employees agree to disagree, thereby generating informed consensus. However, as Infosys’s CFO explained:
“Here, consensus does not mean everyone agrees on everything. It implies finding “binding aspects”. The range of interpretive differences diminishes as one finds these binding aspects…”

**Mentoring** What role can top management play if front-line knowledge workers make most decisions? Surely, managers cannot continue to be the keepers of content as was the case in mass production environments. At Infosys, it appears that managers are part of a larger process of mutual mentorship, a process that the founders hope will create an institution that survives them. Indeed, the philosophy of Infosys’s top management is to recruit people who are brighter than themselves and then mentor them.

How can someone mentor a brighter person? At Infosys, this paradox speaks to a deep sense of security that managers possess. These managers ensure that such security does not turn into complacency by becoming a part of the overall knowledge generation and deployment process. On the one hand, they deploy their considerable experience to guide those under them. On the other hand, they learn from the very employees that they teach. Such a co-mentoring approach, coupled with formal training at Infosys’s Leadership Institute, has served to increase management depth at Infosys. The importance of such mentoring was highlighted recently when Infosys’s Chairman, when he recently assumed the additional role of Chief Mentor.

**Fostering transformative change** Without doubt, the capability to create, harness and govern intellectual capital fully is important. Equally important for a company dealing with continual change is continuity or coherence amidst this change. There are several facets at Infosys that offer such continuity and coherence even as the company confronts continual change.

For instance, it is second nature for Infoscions to offer a model in response to queries pertaining to Infosys’s strategy. Whether it is their overall “PSPD” model, the “Global Delivery” model or the “Customer Relationship” model, these models codify bounds for everyday decisions and actions. For instance, the PSPD Model codifies Infosys’s strategic goals. Infosys’s CEO and Managing Director, explained:

“When we talk about PSPD, we mean that we must build revenue and business models where there is some predictability. We must be able to predict that in the next four, eight or twelve quarters, certain revenue is assured in order to ensure that we manage the growth that is expected from us. Our revenue model has to contain sustainable revenue streams, not revenue streams that die out in a few months and need to be replaced by some other revenue stream. Obviously, everything we do has to generate profits and deliver earnings to the bottom line. We also should de-risk, which means we should not become overly dependent on one technology, one business or one kind of service offering”.
It would be a mistake, however, to think of models such as PSPD as sterile tools applied without reflection to address challenges offered by the continually changing environment. After all, any model is but an aid to decision making and cannot replace human judgment. Indeed, managers at Infosys who use these models are continually reminded of the need to use their judgment.

A second facet that offers Infosys continuity with change is its culture. For Infosys, such cultural mechanisms are embodied in a set of core values which stress meritocracy. As an Infosys middle manager commented:

“The Infosys culture is not an authoritarian or autocratic culture. We all keep each other on our toes. Nobody can rest because this department or that is more powerful than the others”.

The meritocratic culture, together with the emphasis on leadership, excellence and integrity, promotes open communication and sharing among employees. Indeed, a strongly held value within Infosys is that the firm’s knowledge is an asset that belongs to every Infoscion. Also, the unwritten rule within the firm is that if someone can help a colleague, he/she should.

Such sharing and openness also is reflected in Infosys’s commitment to complete transparency in financial and operational aspects. For instance, Infosys reports its financial results to conform to the GAAP of seven different countries around the world. Infosys’s Director of Customer Delivery, revealed another aspect of transparency:

“We are open about our processes and knowledge. For instance, we have published a book on CMM which explains most of our practices. We are also happy to share our knowledge with customers and any one else who asks”.

Indeed, such transparency transforms Infosys into a “naked organization”, making continual improvement and transformation critical for staying ahead.

Besides embracing transparency, Infosys has created a forum called the “Voice of the Youth”. As part of this forum, a group of junior Infoscions are invited to attend Board meetings to voice their opinions freely on any aspects of the business including Infosys’s culture and value system. This forum ensures that the strategy models and core values provide continuity and a common language, but do not become so taken for granted that they stifle change itself.

**Beginnings from endings**

The two faces of the Greek God Janus symbolize an end as well as a beginning. If one were to apply this image to Infosys, we see that the promise of scalability lies in Infosys’s ability to continually evolve from the very platforms it has created. When asked to comment on Infosys’s journey and its ability to respond to future challenges, a founder-Director had this to say:

“Each time we encountered a fundamental challenge, we viewed it as an opportunity to transform the company. We know that the future will pose new challenges. We don’t
know which capabilities we might need. But, we are confident that we will be able to develop these capabilities and meet these challenges”.

This confidence stems from a unique capability to co-evolve with the fluid IT environment within which Infosys operates. Continuity and change are inherent in Infosys’s operations as it uses the very resources and capabilities it has built in the past as platforms to explore and exploit emerging opportunities. Scalability lies in Infosys’s ability to encapsulate its past experiences such that the accumulated stock and associated flows result not in core rigidities – the perpetuation of Infosys as it once was – but in dynamic capabilities that fuel its continual transformation. That is, Infosys represents a continually upgradable platform, a firm that is always in the making.

DISCUSSION

We began this paper by noting that knowledge has become a key resource and that processes to harness knowledge to yield productive services are different from the processes used to harness inert resources. Penrose (1995) had pointed out that it is not a firm’s inert resources but its managerial capacity to identify and exploit opportunities using these resources that determines its growth potential. For a firm dealing primarily with knowledge-infused resources, however, the responsibility to identify and exploit growth opportunities cannot be relegated to top management alone. Instead, it has to be distributed among its many knowledge workers. As opportunities arise in use, it is the knowledge worker who chooses to exploit or ignore them.

Besides the discovery of emergent opportunities, knowledge workers also create new knowledge as they use existing knowledge. As Loasby (1999: 92) pointed out, local engagements can “develop capabilities which can be most effectively used within the context of discovery” (italics added for emphasis). Learning occurs as knowledge workers steer a co-evolutionary process that unfolds as they use knowledge in practice under specific circumstances.

In short, in the very act of exploiting existing knowledge, knowledge workers also explore, a capacity that represents “knowledgeability” (Giddens, 1986: 144). Yet, for such knowledge to result in scalable structuration, a firm must address three challenges. First, it must explicate this knowledge for future use. Second, it has to develop mechanisms that make this knowledge a collective asset accessible by all of its knowledge workers. Third, it has to free itself from path-dependencies in knowledge accumulation that give rise to competency traps and core rigidities.

An exploration of Infosys’s practices offers several insights into how a firm might address these challenges. Consider, first, the challenge of managing the tacit-explicit dimensions of knowledge. Infosys not only recruits its employees for learnability, but it also trains them to exercise “critical judgment”. Additionally, Infosys encourages its employees to learn even as they deploy their knowledge by providing them with a systematic framework – its CMM Level 5 methodology. Indeed, given its
willingness to share its best practices with customers and competitors alike, such learning and the continual improvements that it generates become critical sources of Infosys’s performance advantage.

Such learning involves much more than learning by doing which remains tacit and, hence, may degenerate or be forgotten over time. It requires cultivating a readiness to continually ask “why” or “why not”, draw rough inferences and construct tentative hypothesis (Schon, 1983; Zuboff, 1984; Garud, 1997). As these tentative hypotheses are applied and modified from one context and time to another, new knowledge is created through analytical induction (Glaser and Straus, 1967; Georges and Romme, 2003; Boland and Collopy, 2004). Thereby, learning by reflection allows knowledge workers to say more about what they know and also to do more with what they know.

Mechanisms to manage the tacit-explicit dimensions are also evident in Infosys’s Knowledge Management (KM) initiative. For instance, the People Knowledge Map enables any Infoscion to directly interact with experts and tap their tacit knowledge. Its BOK repositories contain not only the knowledge that arises from reflective thinking on experiences, but also narratives of experiences in specific contexts (Weick, 1995:127; Czarniawska, 1997). These narratives, when coupled with the learnability inherent in each Infoscion, provide the basis for utilizing past experiences in new ways in the future.

In sum, these mechanisms not only enable Infoscions to address emerging issues pertaining to their current knowledge and contexts, but they also result in the creation of new knowledge for the future. But, the utility of such knowledge would be limited if it remained resident in individual employees. Therefore, this private knowledge generated by individuals needs to be converted into a collective good that is also available for use by others within the firm. We have already discussed many of the pressures that prevent private knowledge from becoming organizational. These include ownership and appropriability issues as well as the lack of a forum to harness such private knowledge. Infosys suggests other reasons. For instance, time pressure can prevent people from “closing” projects in such a way that they are easily accessible for reuse in the future. When closure and search costs are high, private knowledge remains so and does not benefit the firm.

Overcoming this challenge requires the firm to pay attention to cultural mechanisms that promote explication of private knowledge for others to use in the future. Such cultural mechanisms are evident within Infosys in statements such as “Every instance of learning within Infosys should be available to every employee”, “Learn once, Use anywhere” and “If you can help a colleague, you should”. They are also evident in the nested co-mentorship processes wherein leaders are willing to “listen and learn” (Leonard, 1998:265) even as they teach those under them.

But Infosys does not rely on cultural mechanisms alone to induce scalable structuration at the organizational level. It has incentivized the system – for instance, by awarding Knowledge Currency Units (KCUs) – to entice Infoscions to explicate their knowledge for use by others. Recognizing that such
explicated knowledge does not become a collective good unless it is used, Infosys awards KCUs even to those who reuse explicated knowledge resident in its repositories.

Indeed, the very ways in which knowledge is organized within Infosys’s KShop portal and the ways in which this knowledge is used in real time co-evolve in an adaptive manner (Bowker and Star, 2000). These dynamics are consistent with the process that DeSanctis and Poole (1994:122) describe: “There is a duality of structure whereby there is an interplay between the type of structures that are inherent to advanced technologies (and hence anticipated by designers and sponsors) and the structures that emerge in human action as people interact with these technologies”. Such co-evolution in an adaptive manner provides Infosys with an automatic and mindful selection mechanism, the key to evolution in high-velocity environments (Eisenhardt and Martin, 2000).

These cultural mechanisms and incentives lay the foundation for an integrated KM initiative within Infosys. Realizing that knowledge is dispersed, Infosys’s KM initiative is not centrally controlled, but centrally facilitated. Such central facilitation ensures consistency of implementation throughout the firm, but provides considerable flexibility to different units or content areas to organize and manage their own “knowledge nodes”. Furthermore, through mechanisms such as E&R Center, DCG and the SETLabs, the KM initiative synthesizes codified knowledge about the different domains or technologies, thereby transforming partial and context-specific private knowledge into useful collective knowledge at a higher level of abstraction. Above all, the KShop portal serves as a common forum for Infoscions, irrespective of their geographic location, to interact with one another, tap each other’s private knowledge and create collective knowledge that benefits the entire firm. In this sense, the KM initiative has set the stage for the creation of “digital options” (Sambamurthy, et al, 2003) that Infosys can strike when the time is right.

The third challenge that a firm faces in inducing scalable structuration is to ensure that it does not become enmeshed in core rigidities. The potential to fall into these traps is ever present because knowledge development can be a recursive process. What is learned and what is useful knowledge is determined by the absorptive capacity of the individual and the organization (Cohen and Levinthal, 1990). If this cycle is not broken, there is a likelihood that the firm progresses in a path-dependent manner till it eventually hits an evolutionary wall (Garud and Karnoe, 2001).

There are several mechanisms at Infosys to prevent this eventualty. First, Infosys ensures that decision rights are distributed among its knowledge workers. Such distribution of decision rights empowers Infoscions not just to exercise learnability, but to also act in a timely manner on the basis of their learning.

Moreover, Infosys continually keeps abreast of its exceedingly dynamic environment, thereby matching its internal knowledge initiatives with its ever-changing environment. For instance, close, long-term relationships with its customers enable Infosys to anticipate their emerging needs and preferences.
Such close relationships also enable Infosys to tap into its customers’ innovative potential. Finally, together with the iterative development process, they allow Infosys to skirt around the challenge posed by “sticky information” (von Hippel, 1994) in addressing customer needs.

In addition, Infosys employs other mechanisms to make sense of its changing environment. Its dispersed development and proximity centers sensitize Infosys to emerging trends over and above those revealed by its existing customers. Likewise, joint projects and investments in start-up companies enable Infosys to emerging technologies and competencies.

The recombination of knowledge is another mechanism for inducing variation (Kogut and Zander, 1992). Rotation of personnel and the cross-functional sharing of knowledge (Nonaka and Takeuchi, 1995) are common occurrences at Infosys as at other firms. But equally important, Infosys has institutionalized this process through structural means. Specifically, Infosys’s E&R Center, DCG and SETLabs combine externally acquired knowledge with the knowledge that Infosys’s business units have accumulated by working on various projects for their respective customers. Thereby, knowledge generated through practice and that generated about possibilities complement one another (cf. Hargadon, 2003), yielding new and unique solutions.

Any other firm would have been content with these mechanisms to ensure that transformation rather than progression results. However, transformation has to be accomplished mindfully. To ensure this, Infosys has created a shared context (Fahey and Prusak, 1998) and a shared identity (Orlikowski, 2002) to inform its decisions and actions. Its strategy models codify key priorities for making decisions, whereas its core values such as sharing and transparency prescribe norms for action. Even as these models and values serve as selection mechanisms to harness variation beneficially, they also provide continuity and coherence amidst continual change.

Over time, however, even these models and values may become taken for granted and stifle change. Therefore, it is necessary for the firm to encourage critical inquiry of these very models and core values. Within Infosys, the “Voice of the Youth” serves such a purpose. By ensuring that even junior employees have the power to question the values and models driving the firm, Infosys has instituted a mechanism for innocent questions to challenge taken-for-granted approaches of the past. In addition, Infosys insistence on transparency ensures that investors and other stakeholders know enough to question its direction and actions.

In sum, Infosys’s initiatives at different levels within the firm serve to induce scalable structuration. As employees socialized into the shared context and endowed with learnability use CMM methodology to learn, they refine existing knowledge and create new knowledge. The KM initiative induces the articulation, codification and prioritization of this private knowledge, thereby converting dispersed and fragmented knowledge into useful collective knowledge. As environmental scanning
matches this collective knowledge with emerging trends, experiments in redepolying knowledge are initiated resulting in the recombination of new knowledge with old. Such recombination, in turn, initiates a reappraisal of the organization’s learning routines and shared context, thereby resulting in organizational transformation that is consistent with the direction of environmental change. Not only do these interactions allow Infosys to co-evolve with its environment, but they also are enabling it to grow and move up the value chain in IT services.

**CONCLUSION**

In this paper, we have attempted to identify processes through which a firm can induce scalable structuration. We suggested that such processes need to address several challenges. They need to address the tacit-explicit dimensions of knowledge, effect a conversion of private knowledge resident in individual employees into collective organizational knowledge available to others, and prevent path-dependent accumulation of knowledge. In this regard, our inquiry into Infosys revealed a nested set of co-evolutionary processes unfolding at different levels within the firm. “Knowledgeability” at the individual level involves reflective learning from deployment. New knowledge created in this process co-evolves with the firm’s collective knowledge which, in turn, determines and is determined by the unfolding governance processes that we described.

Such nesting implies that there are connections between levels – “an interlocking set of experiments” (Loasby 1999:92) – that foster knowledge accumulation. At the same time, autonomy and dispersion of decision rights ensure that there is sufficient variation to effect transformation. In sum, the nested co-evolutionary processes ensure that there is continuity and change built in.

Our perspective on scalable structuration yields several insights. First, it is no longer appropriate to think in terms of knowledge stocks and knowledge flows. Structuration implies that structure is both medium and outcome of action. Consequently, a knowledge-infused resource is simultaneously stock and flow. In its very deployment, it generates new knowledge. In other words, in the context of a firm, “knowledge” is akin to words such as ‘building’, ‘construction’ and ‘work’, designating both a process and its finished product (Dewey, 1934: 51).

A second implication pertains to the dichotomy between exploration and exploitation (March, 1991). Emerging landscapes may have a disruptive impact on a firm to the extent that organizing for exploration is distinct from organizing for exploitation. If a firm were to (re)organize for exploration, its exploitation activities would be disrupted. Alternatively, if a firm were to focus its energies on exploitation, it is likely to hit limits in the future as radical or architectural innovations emerge (Henderson and Clark, 1990). Under scalable structuration, however, this problem does not arise because exploration is a byproduct of exploitation. Also, as the firm co-evolves with its environment, it
endogenizes discontinuities into a series of small, iterative changes (Gavetti and Levinthal, 2000; Quinn, 1978), thereby mitigating their negative impact.

Finally, scalable structuration compels us to think of knowledge as being both tacit and explicit, instead of being either tacit or explicit. As Tsoukas (1996) argued, any articulable knowledge only makes sense given a tacit background. Therefore, transporting knowledge across time and space involves much more than transferring formulae. It includes the context – people, culture and the social relationships – that too have to be transported across time and space. Viewed thus, knowledge transfer becomes an active process of translation (Callon, 1986; Latour, 1991; Law, 1992) and not one of diffusion.

In conclusion, the promise of the post-modern corporation lies in its ability to harness knowledge-infused resources. Mechanisms and processes to harness such knowledge-infused resources are very different from those required to harness inert resources. Implemented properly, these mechanisms and processes can induce scalable structuration, wherein a nested set of co-evolutionary dynamics results in new, transformative knowledge being generated as a byproduct of the application of existing knowledge. Our paper is an attempt to outline how a firm might induce scalable structuration and benefit from the increasing returns that accrue.

REFERENCES


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Table 1. Infosys Technologies: Chronology of Events

<table>
<thead>
<tr>
<th>Year</th>
<th>Events</th>
</tr>
</thead>
<tbody>
<tr>
<td>1981</td>
<td>• Year of incorporation in India</td>
</tr>
<tr>
<td>1987</td>
<td>• Opened first international office in the US</td>
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</tbody>
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| 1992 | • IPO in India  
      | • Launched Bodies of Knowledge (BOK) initiative to codify employees’ knowledge |
| 1993 | • Listed successfully in India  
      | • Obtained ISO 9001/TickIT Certification |
| 1995 | • Set up development centers in several cities across India |
| 1996 | • Established e-Business practice  
      | • Set up first European office in Milton Keynes, UK  
      | • Launched corporate intranet (Sparsh). |
| 1997 | • Attained SEI-CMM Level 4 certification  
      | • Set up office in Toronto, Canada |
| 1998 | • Rated first in Economic Times India’s "Award for Corporate Excellence"  
      | • Implemented People Knowledge Map (PKM) on Sparsh |
| 1999 | • Crossed $100 million in annual revenues  
      | • Listed on NASDAQ  
      | • Attained SEI-CMM Level 5 certification  
      | • Rated “India's Most Admired Company” by The Economic Times Survey  
      | • Opened offices in Germany, Sweden, Belgium and Australia  
      | • Established two development centers in US  
      | • Established Domain Consulting Group (DCG), Software Engineering and Technology Labs (SETLabs) for competence building  
      | • Chartered central KM group and launched company-wide KM program |
| 2000 | • Crossed $200 million in annual revenues  
      | • Became first company to be awarded the "National Award for Excellence in Corporate Governance" conferred by the Government of India  
      | • Opened offices in France and Hong Kong  
      | • Set up global development centers in Canada and UK, and third development center in US  
      | • Central knowledge portal (KShop) launched |
| 2001 | • Crossed $400 million in annual revenues  
      | • Ranked “Best Employer of India” by Business Today-Hewitt Associates  
      | • Opened offices in UAE and Argentina  
      | • Set up new development center in Japan |
| 2002 | • Crossed $500 million in annual revenues  
      | • Opened offices in Netherlands, Singapore and Switzerland  
      | • Attained SEI’s enhanced CMMI Level 5 certification for its onsite and offshore operation  
      | • Ranked “India’s Most Respected Company” in Business World survey |
| 2003 | • Crossed $750 million in annual revenues  
      | • Acquired Expert Information Services Pty Limited of Australia  
      | • Won the Global Most Admired Knowledge Enterprise award |
Figure 1. Infosys Technologies: Growth in Revenues and After-tax Net Income, 1994-2003

Source: Infosys Annual Reports.