Software Engineering Institute

IEEE Computer Society/Software Engineering Institute Software Process Achievement (SPA) Award 2009
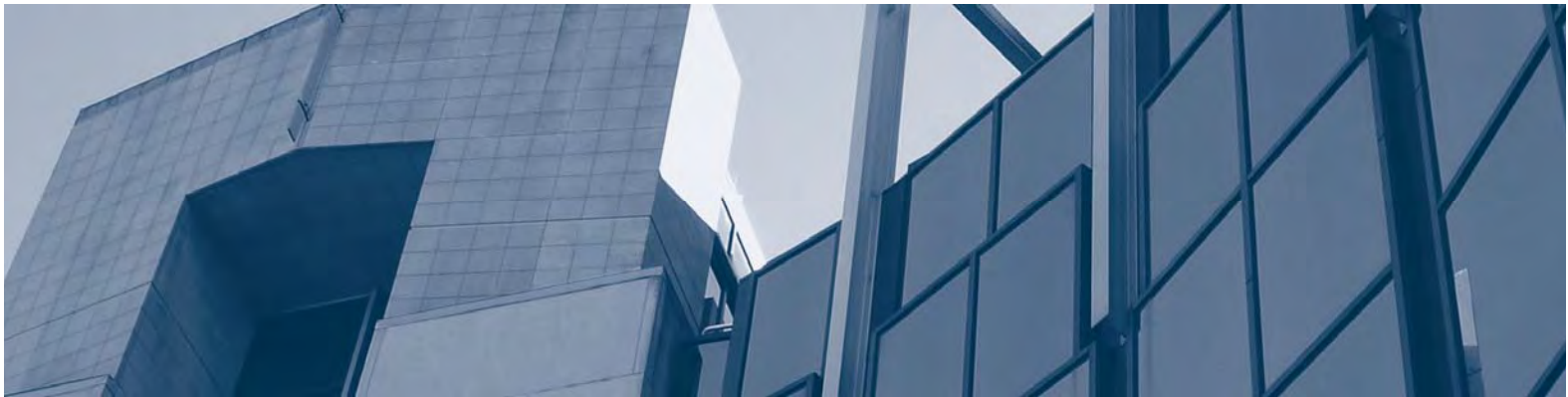
Satyendra Kumar
Ramakrishnan M.

March 2011

Carnegie Mellon

Table of Contents

List of Figures

List of Tables

About Infosys

A corporation that runs on a set of principles has greater chance of building character and lasting longer. We have built our corporation on a sound value system that encompasses openness, leading by example, honesty, transparency, fairness, and excellence in execution.

– K. Dinesh, Director and Head—Communication Design Group,

Information Systems, and Quality and Productivity

Infosys Technologies Limited (NASDAQ: INFY) was started in 1981 by seven professionals with $250. Today, we are a global leader in the "next generation" of information technology (IT) and consulting with revenues of $5.7 billion.[1]

We define, design, and deliver technology-enabled business solutions that help Global 2000 companies win in a Flat World.[2] We also provide a complete range of services by leveraging our domain and business expertise and our strategic alliances with leading technology providers.

Our services span business and technology consulting, application services, systems integration, product engineering, customer software development, maintenance, reengineering, independent testing and validation services, IT infrastructure services, and business process outsourcing.

Infosys[3] and its subsidiaries have a large global presence with over 100,000 employees that are spread across 75 cities in 31 countries. Refer to Table 1 for a snapshot of our company.

Table 1: Infosys Facts at a Glance

Infosys Facts at a Glance, as of December 31, 2010	
Customers	612
Market Capitalization	$44.2 billion
Revenue	$5,735 million*
Net Income	$1,446 million*
Global Presence	75 cities in 31 countries
Employees	127,779
Company	Started in 1981 by seven professionals with $250 and a dream

* last twelve months

---

[1] As of December 31, 2010.

[2] For more information on Flat World, refer to http://www.infosys.com/building-tomorrows-enterprise/pages/index.aspx.

[3] Infosys is a trademark of Infosys Technologies Limited, registered in India and other countries.

Values

The core value system at Infosys captures five important aspects, known as C-LIFE: customer delight, leadership by example, integrity and transparency, fairness, and pursuit of excellence, shown in Table 2.

Table 2:   C-Life: Infosys Values

Infosys Values	
Customer Delight	A commitment to create value for our clients by engaging with them in deep and enriching relationships, anticipating their needs, and surpassing their expectations
Leadership by example	A commitment to define the standards in our business and transactions and to be a benchmark for the industry and to our own teams
Integrity & Transparency	A commitment to be ethical, sincere, and open in all our dealings
Fairness	A commitment to be professional, objective, and transaction-oriented, thereby earning trust and respect
Pursuit of **E**xcellence	A commitment to strive relentlessly to constantly improve ourselves, our teams, our services, and our products to become the best

Infosys Vision and Mission

Infosys was India's first company of the professional, for the professional, by the professional.

Vision

"We will be a globally respected corporation."

Mission Statement

"To achieve our objectives in an environment of fairness, honesty, and courtesy towards our clients, employees, vendors, and society at large"

> *We discussed the objectives of the company and decided that we wanted to become India's most respected company. **Seeking respect was behind our founding Infosys.** We deliberately defocused on revenue and profits. Our goal was to do everything by the book. We realized that if we did the right thing, revenue and profit would automatically come.*
>
> —Narayan Murthy, Chairman and Chief Mentor

Table 3:   Key Media Honors and Select Analyst Mentions

Key Media Honors 2009
• BusinessWeek named Infosys among the world's most innovative companies [Jana 2009]. • Infosys was awarded CIO 100 award at the CIO 100 Symposium & Awards Ceremony in Colorado Springs, Colorado, USA [CIO 2009]. • Fortune Magazine ranked Infosys among the world's 100 fastest growing companies [Fortune 2009]. • According to a survey by the Wall Street Journal, Infosys is India's most admired company [Sheth 2009]. • Infosys won two of the categories on the 2009 list by the Great Place to Work® Institute [Great 2009]. • Infosys was ranked among the top 50 most respected companies in the world by Reputation Institute's Global Reputation Pulse 2009 [Reputation 2009]. • The Hay Group and Chief Executive Magazine named Infosys among the best companies for leaders [Hay Group 2009].
Select Analyst Mentions

2009 NelsonHall

NelsonHall rated our Healthcare Payer transformational and multi-shore delivery capabilities the highest in a vendor survey [Juniper 2009].

2009 Gartner

"Client satisfaction is generally very high. SOA technical skills and expertise in key SOA platform are key strengths. Clients also appreciate Infosys' flexibility to accommodate changing scope and in fee structuring" [Tan 2009].

2009 Saugatech

"In many ways, Infosys is the Accenture of the offshore world, with significant vertical intellectual property that can be leveraged to the Cloud. Infosys pushes vertical expertise in most of its application development deals, and just like Accenture, it has a strong Microsoft relationship" [McNeill 2009].

2009 Forrester

"Infosys has developed a Customer Value Management suite to help telcos manage their high-value customers … designed to enable the telco to develop deeper relationships" [Cansfield 2009].

2009 Forrester

"Infosys is becoming a trusted brand in North America for SOA systems integration capabilities." Infosys is in the number 1 position in terms of 'Current Offering' beating out these other vendors: Accenture, BearingPoint, Capgemini, CSC, Deloitte, HCL, IBM, TCS, and Wipro" [Sheedy 2009].

2009 Forrester

"Outstanding reference client scores—and a standout story on innovation for clients—gave Infosys a significant boost in the current offering rating" [Roehrig 2009].

2009 Forrester

Infosys is a strong performer in Forrester's IT organizational redesign consultancy wave [Cecere 2009].

2009 Forrester

Finacle* from Infosys is among the leaders in Forrester's Global Banking Platform [Hopperman 2009].

2008 Gartner

Infosys is among the leaders in Gartner's Magic Quadrant for Offshore Application Services [Marriott 2008].

®   Copyright© 2005 GREAT PLACE TO WORK® Institute, Inc.

*   Finacle is a trademark of Infosys Technologies Limited, registered in India and other countries.

Abstract

Infosys Technologies Limited received the IEEE Computer Society/Software Engineering Institute Software Process Achievement (SPA) Award 2009 for establishing a cost-effective, sustained, and culturally integrated quality and productivity improvement program during a period of extraordinary corporate growth. For more information on the SPA Award, visit http://www.computer.org/portal/web/awards/technical.

1 Business Imperatives

The key business imperatives essential to ensuring that the business results Infosys delivers are sustainable over the longer-term are

- proven Global Delivery Model
- accelerated growth
- our differentiated services

1.1 Global Delivery Model

Infosys pioneered the Global Delivery Model (GDM), an innovation that led to the rise of off-shore outsourcing. The GDM is based on the idea of taking work to the location where the best talent is available and where it makes the best economic sense with the least amount of acceptable risk.

The GDM enables us to derive maximum benefit from our large pool of highly skilled technology professionals, have 24-hour execution capabilities across multiple time zones, have the ability to accelerate delivery times of large projects by simultaneously processing project components, stay competitive with regards to cost across geographic regions, build in redundancy to ensure uninterrupted services, and have a knowledge management system that enables us to reuse solutions where appropriate.

Our GDM mitigates risks associated with providing offshore technology services to our clients. We use multiple service providers and a mix of terrestrial and optical fiber links with alternate routing to create the fastest and most effective communication possible. In India, we rely on two telecommunication carriers to provide high-speed links interconnecting our global development centers. We also rely on multiple links on submarine cable paths provided by several service providers to interconnect our development centers (DCs) with our network hubs in other parts of the world.

1.2 Accelerated Growth

A company's ability to scale is vital for longevity and prosperity. Business growth generates customer demands for stronger, more stable partners who deliver more value at an ever-reducing cost. Employees need the growth to expand their horizons and careers, and investors expect growth as a matter of right. Scale permits companies to build their brand and human capital; to seize market share; to amortize huge costs on sales, administration, and research and development (R&D); and to build a financial war chest.

Growth is also about aspirations. The only difference between the Infosys of the 1980s and the Infosys of the 2000s is that the aspirations changed dramatically. There is no substitute for setting audacious goals, and there is no substitute for dreaming big. In a world obsessed with change and flexibility, companies that build scalable resilience rule the market.
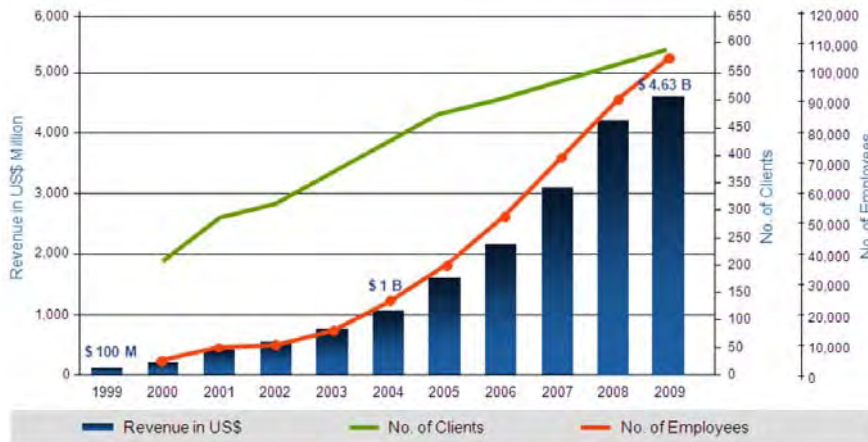
Figure 1: Infosys Growth Over the Years in Employee and Client Numbers

We have grown with metronomic regularity, shown in Figure 1, without compromising on the quality of our services. This is because of our business models, leadership, values and aspirations, and scalable processes and systems.

1.3   Differentiating Our Services

We seek to continually enhance our portfolio of solutions as a means to develop and grow our business. To differentiate our services, we focus on emerging trends, new technologies, specific industries, and pervasive business issues that confront our clients. In recent years, we have offered new services, such as consulting, business process management, systems integration, and infrastructure management. These have been and should continue to be major contributors to our growth. We established Infosys Consulting to add additional operational and business consulting capabilities to our GDM. We also introduced software as a service (SaaS) as part our technology solutions and have further enhanced our ability to service our clients through modular global sourcing and other refinements to our GDM.

We continue to build specialized industry expertise in the financial services, healthcare, manufacturing, telecommunications, retail, transportation, and logistics industries. We combine deep industry knowledge with an understanding of our clients' needs and technologies to provide high-value, quality services. Building on our extensive industry expertise, we plan to provide our services to new industries in the future.

With the exceptions of application development and maintenance, our service revenues have grown from 44 percent in 2005 to 60 percent in 2010. We have a diverse portfolio of services to cater to the demands of our customers. We constantly expand our expertise in the latest technologies and evolve new services to provide a technological edge to our client organizations.

The information technology (IT) services sector is currently witnessing an unprecedented demand for quality. More and more, customers, investors, and employees are gravitating toward companies that have high-quality management teams, deep client relationships, impeccable track records of customer satisfaction, a de-risked business model, high financial discipline, a strong value system, and, above all, the ability to manage change. With our strong delivery and solid strategy, Infosys continues to differentiate itself from other companies in the IT sector.

2 Challenges and Opportunities

Because of the growth of our company and our desire to continuously expand our services, Infosys is constantly faced with challenges to standardize, institutionalize, and execute various processes across our company.

2.1 Scale

We have continued to grow over the years, and with growth comes complexity. Any inability to manage our growth could disrupt our business and reduce our profitability.

At Infosys, we take a simplified, process view of business. Operations are managed through 15 key process families, composed of over 140 specific processes. The Process Repository at Infosys for Driving Excellence (PRiDE), our web-based platform, is the storehouse of our company processes. These processes cover Infosys' business units and business-enabling areas.

Infosys has focused on building scalable, integrated processes and systems to manage rapid growth. This focus has enabled us to work across time zones, leverage the diversity of our talent, and establish new standards in execution excellence across our global locations.

This focus also allows location-independent execution across our 50+ global DCs. We have the flexibility to distribute engagements and projects across our global DCs, which, in turn, contributes to higher productivity, greater client satisfaction, and a rate of over 95 percent in repeat business.

2.2 Portfolio Diversity

Infosys aims to provide valuable solutions by using our in-depth industry expertise and by expanding the services we offer to meet our clients' needs. With both new and existing clients, our goal is to grow with them, changing to accommodate the nature and scope of our engagements with each of them on an individual basis.

To meet the challenges of providing end-to-end business solutions for our clients, we have a well-defined methodology to update and extend the services we offer to meet the evolving needs of the global marketplace. Various mechanisms work synchronously within the Infosys organization to make us agile enough to meet customer demands. Industry and technology R&D focus groups help to assess customer needs and tailor existing solutions to suit those needs. If we reach a critical mass of projects that require similar, specialized services, our process group provides us with guidance on standardizing these services.

2.3 Operational Excellence for Higher Value

Infosys is committed to superior quality and process execution. Our project management methodology is sophisticated and ensures timely, consistent, and accurate delivery of superior quality solutions to maintain a high level of client satisfaction. We constantly benchmark our services and processes against globally recognized quality standards. We have received the following certifications, accreditations, and assessments:

- CMMI® framework, level 5
- CMM® framework, level 5
- TL 9000® certification
- ISO 9001:2000 certification
- AS/EN 9100 certification
- ISO 2000: 2005 certification
- ISO 27001: 2005 certification
- ISO 14001: 2004 certification
- ISO 13485 certification
- BS 25999-2: 2007 implementation

Our client contracts are often conditioned upon our performance, which, if unsatisfactory, could result in lower revenues and profitability. However, as a testimony to our commitment to high performance ideals, we have been deriving over 95 percent of our revenues from repeat business year after year.

---

3 Strategic Quality Plan

We seek to strengthen our position as a leading global technology services company by successfully differentiating the services we offer and increasing the scale of our operations. It is our constant endeavor to enhance the customer experience, achieve higher operational excellence, and grow our intellectual capital while continually giving attention to the sustainability of our current processes and systems.

Our strategic focus on these goals, along with our aspirations and governance, has helped us achieve significant performance year after year.

3.1 Enhance the Customer Experience

Infosys meets customer business and strategy needs through consultations, services, and products. We provide an extensive portfolio of services to address the varied and complex requirements of our customers. Our comprehensive service model enables customers to derive maximum value for their IT expenditure. The model encompasses the application life cycle, best-of-breed methodologies, GDM, structured knowledge management, tools, and intellectual property developed by our centers of excellence. Our services are based on industry-standard frameworks (such as CMMI) that combine rigorous processes with excellent domain expertise.

As an IT services company, our commitment to client value is well defined. Our annual customer satisfaction survey (CSAT) is an important tool through which we gauge the experience of our customers globally. This survey rates us on key parameters and compares us with other global IT service companies. We analyze the feedback we get from these surveys and identify important areas for improvement, such as business strategy, delivered solutions and services, employee skills, and innovation.

Our Enterprise CSAT improvement program is headed by the chief operations officer and managed by the quality department, with representation from the executive council (EC). This program forms an action group with co-opted teams from units across the company. The action group identifies the areas where Infosys needs to improve; decides upon the actions that need to be taken; sets, integrates, and aligns innovative goals; and creates customer relationship development plans. This process has produced continuously high levels of customer satisfaction, even during the economic slowdown of 2009.

Governance processes, which are a part of the Enterprise CSAT improvement program, enable and monitor actions at three levels: the organizational level, the unit level, and the account level. The organizational-level initiatives are owned by the EC members, and quarterly progress reports are submitted to them. Unit-level reviews are conducted by the unit heads and facilitated by the unit-level CSAT action team. Account-level actions are monitored by the account-management teams. Aggregated statuses are evaluated during the unit-level review.

The key high point of the Enterprise CSAT improvement program is its clean, analytical approach: it identifies problems and finds solutions using the collective knowledge of Infosys' lea-

dership. This program generates collective enthusiasm and contributions across the organization, helping us to reach and exceed our goals.

3.2   Achieve Higher Operation Excellence

From 1993 to 2005, we leveraged lessons from the CMM and CMMI frameworks: improvements were consolidated, and a foundation was laid with a software process repository, software engineering automations, a project management system, and ISO and CMMI certifications and assessments. Since then, the quality department has focused on application development and maintenance (ADM), as well as non-ADM areas, such as package implementation and infrastructure management services. It has created robust execution methodologies for new services on an ongoing basis and strengthened existing services by taking software engineering improvements to the next generation, allowing us to deliver superior value to the clients. This has led to our "next generation engineering solutions." These next gen solutions brought about quantum improvements to our service delivery parameters and delivered quality. This leap across the organization required flexible change management and sustainable mechanisms.

Some of the key improvement initiatives are

- enterprise reuse program. Our enterprise-level team promotes standardized component usage across the company. It is involved from developing enterprise-wide technology and business-component strategy to having a robust system-based integration for the usage of components. This has resulted in over 65 percent of business engagements that use 4,000+ technical and business components.

- engineering tools program. Our enterprise-level team scans the industry for the best tools and optimized licenses using a structured assessment framework. The team then deploys them aggressively throughout the organization. Today, our tools usage index is 80 percent, which indicates a wide usage. We boast of having a flexible tools framework that covers over 80 percent of the technology stack and all of the software life cycle stages (from requirements to testing).

- agile development methodology at Infosys (Infy Swift).[4] Our differentiated methodology for the GDM enables a short-cycle delivery approach using the best practices of iterative and the "predictable Infosys process" to achieve faster time to market.

- Infosys program management framework (TRANSCEED). Our initiative to enhance program management capabilities includes the development of integrated systems and tools, relevant enabling and certification, and fostering an ecosystem for collaboration and knowledge exchange.

- Infosys production support methodology (PROSPER). This is our unique methodology for driving excellence in production support services.

- Total Integrated Delivery Environment (TIDE). Our integrated delivery platform can execute projects in various technologies.

---

[4]   Infy is a trademark of Infosys Technologies Limited, registered in India and other countries.

- Business results impact at Infosys Technologies (Infosys Brite).[5] Our IT-specific Six Sigma approach with statistical predictive modeling addresses diverse business critical parameters to provide breakthrough improvements.

- Estimation Center of Excellence (Infosys Esteem).[6] We strive to standardize estimation techniques and models for various service lines and implementations.

- Business Value Articulation. Our quality department, in collaboration with multiple stake-holders, developed this framework to ensure that our approach aligns with our customers' needs.

3.3   Growing Our Intellectual Capital

The changing technological scenario in the industry today is driving companies to focus on services with greater value. In this competitive environment, the success of the Infosys business model hinges on the ability to develop the knowledge and skills of its people, guiding them to become effective leaders.

At Infosys, we have scaled up our education and leadership development infrastructure significantly to meet our growing business needs. Training at Infosys is a continuous, integrated process. We have a 14.5-week, intensive, entry-level, primarily technical training program in place. Every employee, called an Infoscion,[7] completes a minimum of 10 days of training each year. We have expanded our training capacity across the DCs and have nearly 150 faculty members dedicated to training. The Infosys Leadership Institute (ILI) at Mysore, the largest residential education center in the corporate world, has the capacity to train 14,000 employees at a time.

We have grown from offering a few hundred training and competency development programs to offering several thousand across various groups, such as quality, education and research, and the ILI. We have established a defined, role-based competency framework across the business, which divides training into four focus areas: technology, domain, quality process, and personal effectiveness. Infoscions can receive managerial training and leadership development, as well.

Technology competency trainings at Infosys have over 160 mid-level programs across various technologies and capabilities. With our focus on quality processes and methodologies, we offer process training that is tailored to the technical role of the Infoscion. In addition, new courses are made available on request. We also encourage employees to opt for part-time and long-distance training programs.

We believe in investing today to create tomorrow's leaders. Our training processes focus on nurturing a large number of high-quality leaders with global perspective. The Infosys Leadership System and the ILI create a formal, defined system to develop leadership and management capabilities in our Infoscions. A leadership competency model assesses and trains Infoscions on key parameters, such as performance focus, interpersonal effectiveness, organizational savvy, ability to develop leaders and drive change, customer partnering, and technical and functional expertise.

---

[5]   Business results impact at Infosys Technologies and Infosys Brite are trademarks of Infosys Technologies Limited, registered in India and other countries.

[6]   Infosys Esteem is a trademark of Infosys Technologies Limited, registered in India and other countries.

[7]   Infoscion is a trademark of Infosys Technologies Limited, registered in India and other countries.

Seminars and best-practice sessions, regular features at Infosys, focus on sharing knowledge, mentoring, giving feedback, and continuously reviewing systems and processes. Mentoring, a key part of our training process, is critical in developing the Infoscion's skills and aligning individual targets with overall strategic goals. Mentoring sustains employee motivation and ensures constant communication between various levels at Infosys.

With our rapid growth, classroom-based training has become increasingly difficult. Time constraints and the diversity of the audience add to this complexity. To address these challenges, we have adopted varied approaches that use technology to provide flexibility in terms of space, time, and pace of learning:

- E-Learning entails a sophisticated infrastructure, complete with a learning management system and a local server in each geographical area.

- Knowledge management (KM) learning introduces a centralized learning process based on four basic areas—people, process, technology, and content. Because of our KM process, Infosys has won the Asian Most Admired Knowledge Enterprise (MAKE) award every year since 2002, with an exception in 2008. We are the first Indian company to have won the Global MAKE Award every year since 2003, with an exception in 2006. We were also the first Indian company to be inducted into the Global MAKE Hall of Fame, which occurred in 2005.

- Infosys has a training and certification policy that mandates that Infoscions complete 10 training days and 2 certifications a year. (See Table 4.) This policy has been institutionalized over the last 2+ years.

Table 4: Number of People Covered by Certification Programs

Competency Area	Number of Certifications	Number of People Certified in a Two-Year Period *
Technology	2,024	143,924
Domain	805	127,899
Project Management	3**	9,780
Process Management	7***	37,800

* An employee can have more than one certification.
** There are three separate certifications that are based on roles within project management.
*** These certifications cover software quality, process management, process improvement models, and process improvement methods like DMAIC and Lean.

Sustainable growth depends on our ability to nurture and grow the intellectual capital within the company. Today, we have several well thought-out recruitment and competency programs that address our growing needs and develop the skill sets of our Infoscions. This ensures that, as we grow and enter into new markets, services, and domains, we have the talent to continually delight our customers.

3.4   Sustainability

Infosys has invested significantly to strengthen the processes and systems that enable our business' scalability. Our quality and productivity (Q&P) standards are benchmarked globally with the industry's best standards and frameworks:

- CMMI framework, level 5
- People CMM framework, level 5
- Malcolm Baldrige Performance Excellence Program
- European Quality Standards

Our continuous improvement assures us that our operations are repeatable, predictable, and scalable. Our processes and system scalability have enabled us to build an institution that can respond rapidly and predictably to client requirements, to our strategies and aspirations, and to the dynamic business environment in which we operate. This predictability is the anchor of the promise we make to our stakeholders: "Improve your odds with Infosys' predictability."

With this predictability in mind, Infosys is committed to a high standard of business continuity management for our clients, employees, and other stakeholders. Infosys has a detailed business continuity plan, the Phoenix Plan, at the corporate level. Redundancy has been built into our entire essential infrastructure, including office space, network connectivity, power, computing resources, and personnel. This redundancy can be seen in each of our DCs, which are all self-sufficient:

- alternate power generation
- sustained 24-hour operations with physical security
- availability of potable water
- accommodation facilities
- cafeteria and recreational facilities
- availability of immediate medical care

Additionally, each Infosys DC has another DC designated as its offsite storage and recovery location. This backup facility is actually a warm site with space and equipment in place and is chosen to ensure adequate geographic separation. This selection is also based on connectivity, space, and other key parameters specific to the client.

The business continuity plan (BCP) is a comprehensive set of steps to be taken before, during, and after a disaster. The plan is documented, communicated, and tested to ensure the continuity of business operations and availability of critical resources following a disaster. This plan is made available at all of our DCs.

Based on the Phoenix Plan, Infosys conducts disaster recovery (DR) tests every six months for select projects across the facility. Projects with different characteristics are selected to ensure the thoroughness of the test. Typical aspects tested include establishing alternate connectivity with onsite locations, looking at the time involved in recovering data from backups and bringing up the applications, and maintaining continuity of service during a switchover. The test scenarios can be customized based on our client's specific requirements.

We work with various stakeholders to ensure that all necessary BCP plans are developed, deployed, tested, and reviewed for effectiveness.

3.5   Goal Setting and Governance

One of Infosys' strengths is the speed with which we understand and respond to changes in stakeholder needs. Rather than conducting an annual environmental scan to understand changes, Infosys operates with its ear to the ground throughout the year. The information we collect is consolidated to develop short-, medium-, and long-term perspectives. Considering the industry and the environment in which Infosys operates, the planning horizons are one year for short term, three years for medium term, and five years for long term, shown in Figure 2. During strategy meetings, short-, medium-, and long-term goals are defined. While broad goals are developed for horizons of three, five, and eight years, specific goals are defined for the first three years.
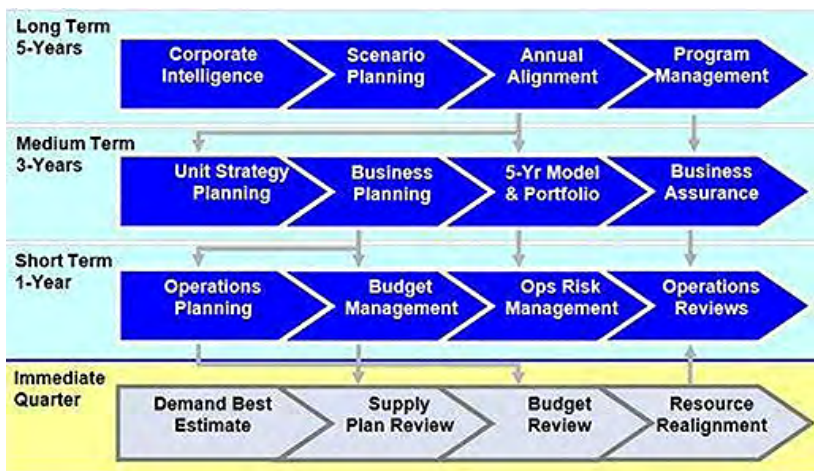
Figure 2:   Short-, Medium-, and Long-Term Planning Horizons

Planning is important, but "excellence in implementation" is essential for business success. Therefore, Infosys follows a structured strategy implementation process. This process focuses on ensuring that strategic directions translate into actions that are successfully executed. Coupled with operating processes, deployment concludes with a set of reviews.

Based on the balanced scorecard methodology, our goal setting is primarily based on benchmarks and market performance. Scorecards are passed down from the CEO to the head of quality and then to the multiple layers of the quality department. The quality department coordinates their goals with the delivery units. They also ensure business connectivity and clear alignment through the balanced scorecard approach, using the Infosys Scaling Outstanding Performance (iSOP) framework to evaluate, identify, and make improvements across business units. The Infosys performance management system is tightly coupled with scorecard achievement. In addition to helping us achieve our goals, the scorecard mechanism also helped us win a place in the prestigious Balanced Scorecard Hall of Fame.

Infosys' governance mechanism includes multiple review meetings across all levels. Each quarter, the head of quality presents performance metrics and provides updates on initiatives and insights to the management council meeting, chaired by the CEO. Quality and productivity are of the ut-

most importance in the quarterly unit operations meetings. The results of these quarterly governance meetings flow down to the weekly meetings held by the delivery and quality teams, and the quality teams, in turn, anchor CEO and board of directors (BOD) reviews of projects in order to share best practices across the company.

The quality department also anchors our PRIMA awards, which are quarterly awards that celebrate excellence in project execution, client delight, and technology excellence. Case studies of the winners and finalists are published on the Infosys intranet, which encourages best practices at the project level.

4 Quality Organization at Infosys

4.1 Organizational Structure

The quality department, which reports directly to the BOD, provides a strategic advisory role to the board and delivery teams. Our systematic approach to quality assurance attracts committed leaders, and our high level of quality ensures that Infosys continues to be an industry leader. Our commitment to quality starts with the annual business plan for the company (STRAP), where detailed analyses are performed by leveraging the organization's measurement systems. Typical yearly analyses involve process capabilities across technologies, services, predictive correlations, annual customer satisfaction results, and industry feedback.
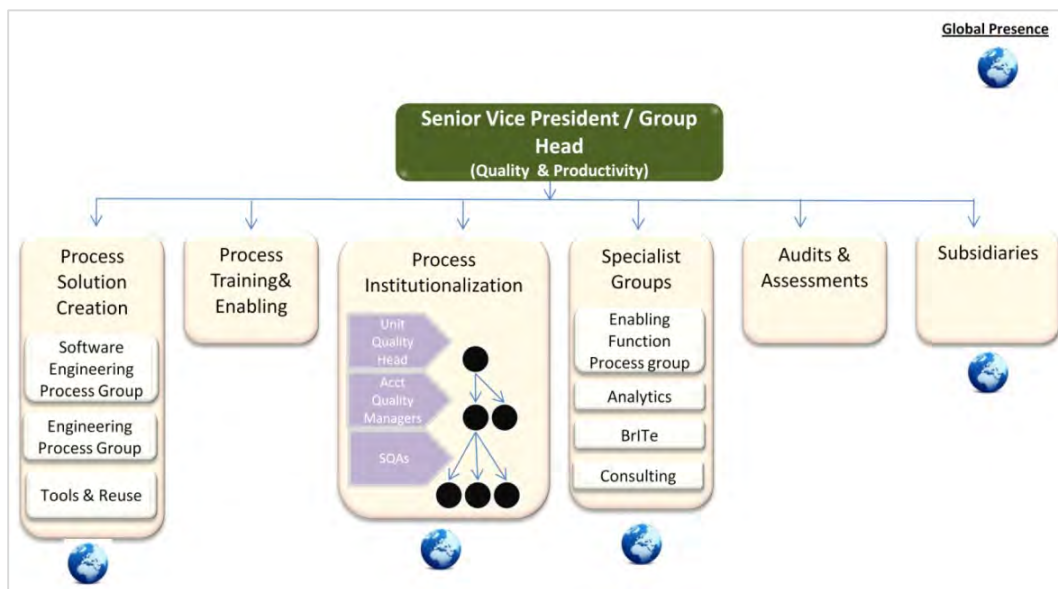
Figure 3:   Organization Chart for Quality and Productivity

The quality department provides leadership and a unifying focus for the organization's Q&P improvement efforts, which revolve around customer delight. In line with our Q&P charter, the quality department offers key services towards

- process definition
- improvements and institutionalization
- the direction of large change management programs at organizational and unit levels
- the tools and reuse program at the organizational level
- measurement and analysis for effective decision making at all levels of management
- competency development on processes and systems
- risk management through proactive assessment and reporting projects
- independent audits and assessments
- process consultancy for our customers

The quality department acts as the end customer's representative within the organization. A group within the quality department, the process transformation group, works closely with our delivery department to provide adequate support and input for quality assurance. The quality department constantly creates and delivers solutions that take into account the needs of our end customers, our internal customers, and our senior management. This ensures greater customer satisfaction and a consistently improving trend in Q&P.

4.2   Process and System Institutionalization

With Infosys' rapid growth, the number of Infoscions grew until they were spread across the globe in over 50 locations and subsidiary companies. This required a sustainable, large change-management program that allowed for accessibility and the smooth execution of single programs and projects between multiple locations. This required us to carefully address several aspects of change management:

- skilled process group. Our skilled software engineering process group has multiple teams with specialized skills. This includes an enhanced metrics group with statistical analysts; Six Sigma specialists; and an excellence group focusing on strengthening business-enabling functions, a quality academy for enablement, and enterprise quality solutions to provide quality consulting solutions. The quality department's strength has increased by over 50 percent in the last four years.

- organizational structure. Infosys' head of quality reports to a director and a board member. Our process transformation group drives process improvements and institutionalization while focusing on corporate strategies. This group reports to both the business unit and quality department.

- culture. Effectively engaging employees and promoting a culture of improvement is vital for successful change management. Infosys' culture is strengthened by rewarding and recognizing excellence, sharing best practices, receiving CEO reviews, obtaining leadership commitment for large initiatives, and ensuring alignment with employee performance management systems.

- infrastructure. Early on, we invested in systems to assure quality and process implementation. Infosys built on the foundation of project management systems and created an integrated systems environment from proposal to delivery. Commitments to clients are tracked from the proposal stages to the actual order and, finally, to the integrated project management system. This has helped Infosys create a metrics database of high data quality and data integrity between systems.

- knowledge clusters. Our quality academy advises Infosys on process and project management capabilities. TRANSCEED, Infosys Esteem, Six Sigma, and the iSOP program (based on the Malcolm Baldrige Performance Excellence Program) are other knowledge clusters aimed at creating certified professionals. The unit-specific competency programs are deployed by competency councils that are linked to the performance management system.

At Infosys, processes and IT systems are discussed in the same breadth. Today, we manage our business using more than one hundred applications that ride on a state-of-the-art, scalable technology infrastructure. We have achieved global deployment through the extensive automation of our business processes using the latest technology and system-governed workflows. Because of

this we have reduced the cost of doing business. Our focus on creating a paperless work environment has increased productivity, reduced the risk in daily operations, and reduced manual error because data is captured at the point of transaction. We have automated our key business processes, such as managing client relationships, ordering through remittance, integrating project management, and deploying our talent where it is needed. Business-enabling areas, such as talent management, performance management, and recruitment and asset management, have also been automated.

Automated workflows, such as leave, loans, reimbursements, and travel, ensure seamless and effortless business across time zones.

Process automation has enhanced the measurability of key business processes on vital parameters. Infosys has used this to implement multiple, agile dashboards at various levels. These dashboards serve two key objectives: They provide a view into the performance of end-to-end processes (for example, opportunity to remittance), and they offer a systematic view into integration across processes (for example, budgets versus commitments). Dashboards assess the pulse of business on biweekly, monthly, and quarterly frequencies and align with environmental changes. These dashboards are enforced by our ongoing review processes that assess performance. The Infosys intranet, Sparsh, is instrumental in the global deployment of systems, while the extranet is instrumental in ensuring secure access to the mobile workforce across operating locations.

4.3 Process Repository at Infosys for Driving Excellence

PRiDE is the Infosys way of working. PRiDE (Figure 4) has evolved from a process repository to a collaborative, knowledge-based environment for all business execution process. As a focused strategy, this was re-architected using a component-based work bench and has helped Infosys manage processes much more efficiently and effectively. New process creation cycle time has been reduced by more than 70 percent, ensuring reach and access of process across all geographies and to over 1,00,000 people in a span of five years. PRiDE offers decentralized scalability to subgroups and provides sophisticated search mechanisms and preconfigured help. This has helped Infosys successfully deploy practices across all our new centers. PRiDE is a framework with robust methodologies, project management practices, and processes for the integrated delivery environment.
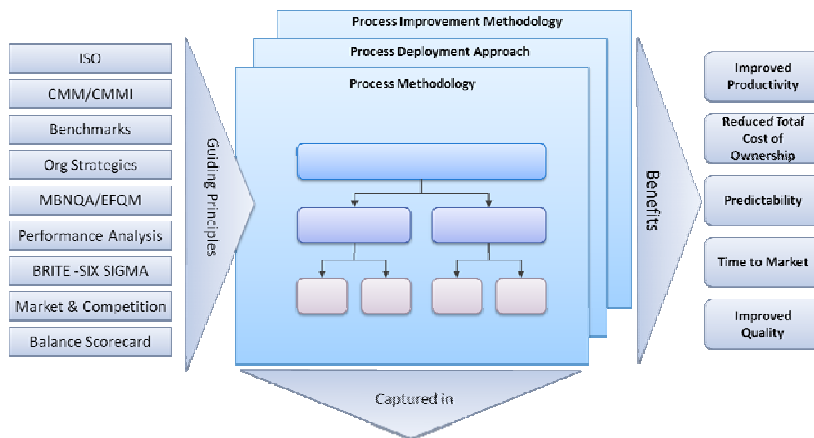
Figure 4:   Constituents of the Process Repository at Infosys for Driving Excellence

4.4 Integrated Project Management Suite

The Integrated Project Management Suite (IPM+) covers project and life cycle management for all the standard services we offer and is continuously updated to cover new services. Using IPM+, we can clearly see our projects, reduce our delivery risks, and improve our productivity through prescriptive processes and customizable workflows, as shown in Figure 5.
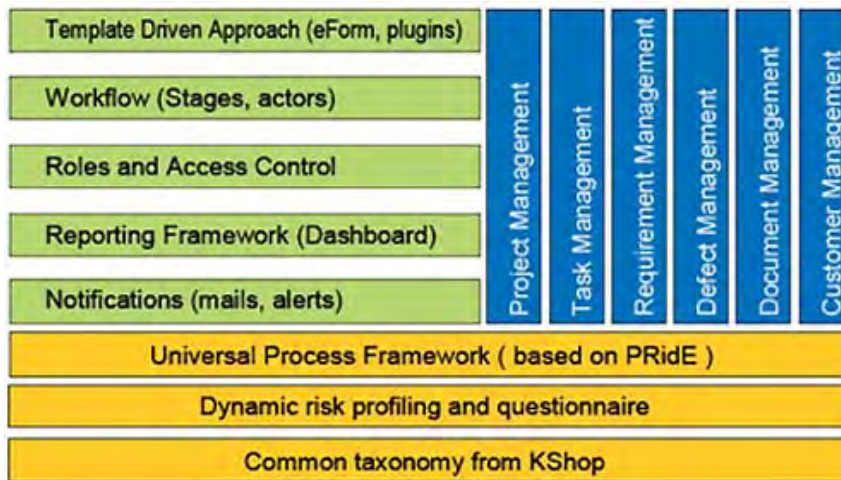
Figure 5: Integrated Project Management Suite

IPM+ handles all of the services we offer with agility, ensures standardization, provides workflow-driven process automation, actively supports reuse and KM, integrates with third-party systems, and is built on loosely coupled components. Due to its scalable template-driven structure, cycle time to implement a new process is about four to six weeks. IPM+ is the platform for effective deployment of various organization-wide improvement initiatives. Some examples of the significant new capabilities brought out by IPM+ are

- periodic, questionnaire-driven risk assessment to facilitate high-risk project identification
- visibility into contract- and proposal-level risks
- metrics report and a process database (PDB) for all processes to provide visibility into execution
- customizable goals for aligning project-level goals with stakeholders' expectations
- engagement feedback logging and tracking
- granular visibility into project execution through the global inbox, change requests, action items, minutes of the meeting, tracking, and workflow
- an alternate way for task scheduling through Excel, which works even in client locations
- personalized settings, such as table views, my filters, and advanced filters

4.5 Independent and Integrated Audits and Assessments Ecosystem

Infosys created an independent audit group to address all audits and certifications across all locations and services. While retaining our ISO and CMM certifications, we made investments in industry-specific external certifications and assessments (telecommunication, aerospace, business process outsourcing, and Malcolm Baldrige). Today, Infosys has a virtual, global, certified auditor

team of over 2,000 people. The scope of audits includes service lines (such as development, main-tenance, and package implementation) and enabling functions (such as the human resources department and finances). These audits are managed by a system called INSIGHT that integrates all audits, such as customer audits, process audits, special audits, information security audits, and external audits. Senior management has access to this information, and these audit findings are reviewed on a regular basis. This comprehensive system provides insights into business risks and improvement opportunities. Our chief risk officer reviews all audit findings and discloses those findings to the BOD.

Infosys follows an integrated approach toward audits and assessments. Today, all subsidiaries, locations, and functions (for example, support, delivery, and information security) are covered by process audits.

Our focus shifted significantly in 2004–05 when an independent team was formed to integrate all audits and assessments. This team of certified auditors conducts regularly scheduled functional audits, as well as special audits based on periodic risk assessment.

Table 5, Table 6, Table 7, and Table 8 summarize the focus areas of external audits that are conducted.

Table 5:   Infosys Technologies Certification/Assessment

Infosys Technologies Certification/ Assessment	Number	Agency	Initial Certified/Accredited/ Assessed Date	Valid Until
ISO 9001:2008	22865/A	BVC, UK	November 1993	November 2011
AS EN 9100	22865/B	BVC, UK	November 2004	November 2012
ISO 9001: 2000 / TL 9000 SR 4.0/R4.0	217598/B	BVC, UK	April 2009	January 2013
ISO 20000: 2005 (CCD/TIG)	42042-2008-AQ-IND-itsmf	DNV, India	April 2005	April 2011
ISO 27001 : 2005	22865	BVC, UK	December 2003	December 2012
ISO 14001:2004	4087CC1-2007-AE-IND-RvA Rev. 01	DNV	March 2004	May 2013
OHSAS 18001: 2007	33347CC1-2008-HSO-IND-DNV Rev. 01	DNV	July 2007	July 2013
BS 25999-2: 2007	BCMS 556300	BSI	November 2010	October 2013
ISO 13485	30081-2008-AQ-IND-NA	DNV	July 2008	July 2011
SEI CMMI Level 5	NA	IPS, LLC	December 1999	August 2013

Table 6:   Infosys Australia Certification/Assessment

Infosys Australia Certification/ Assessment	Number	Agency	Initial Certified/Accredited/ Assessed Date	Valid Until
CMMI Level 5	NA	IPS, LLC	June 2005	September 2011
ISO 9001:2008	22865	BVC, UK	June 2009	December 2012

Table 7:   Infosys China Certification/Assessment

Infosys China Certification/ Assessment	Number	Agency	Initial Certified/Accredited/ Assessed Date	Valid Until
CMMI Level 5	NA	IPS, LLC	July 2010	July 2013
ISO 27001 : 2005	9673-2007-AIS-IND-UKAS	BVC, UK	October 2007	October 2012

Table 8:   Infosys Mexico Certification/Assessment

Infosys Mexico Certification/ Assessment	Number	Agency	Initial Certified/Accredited/ Assessed Date	Valid Until
ISO 9001: 2008	22865	BVC, UK	October 2009	November 2012
ISO 27001 : 2005	22865	BVC, UK	October 2009	October 2012

4.6   INSIGHT

INSIGHT is the integrated audit system that manages all types of audits across the enterprise. It covers projects, support functions, customers, information security, intellectual property (IP) audits, BCP, subsidiaries, and so on. The system has a built-in sampling logic for selecting the projects that need to be audited based on their levels of risk. It manages the required logistic details, provides audit rationalization, gives an integrated view of all types of audits across the organization, and selects the auditors based on their competencies and specializations. INSIGHT serves as a customer audit findings repository and allows for the governance of each audit.

5 Measurement, Analysis, and Knowledge Management

5.1 Multi-Level Data Analysis and Governance

Infosys is managed using quantitative data. Our data-driven approach to quality improvement has led to the institutionalization of a broad, robust metrics program. From the project level to the organizational level, metrics are captured and analyzed, and improvements are made based on these metrics. Figure 6 gives an overview of our multi-level data analysis and governance.
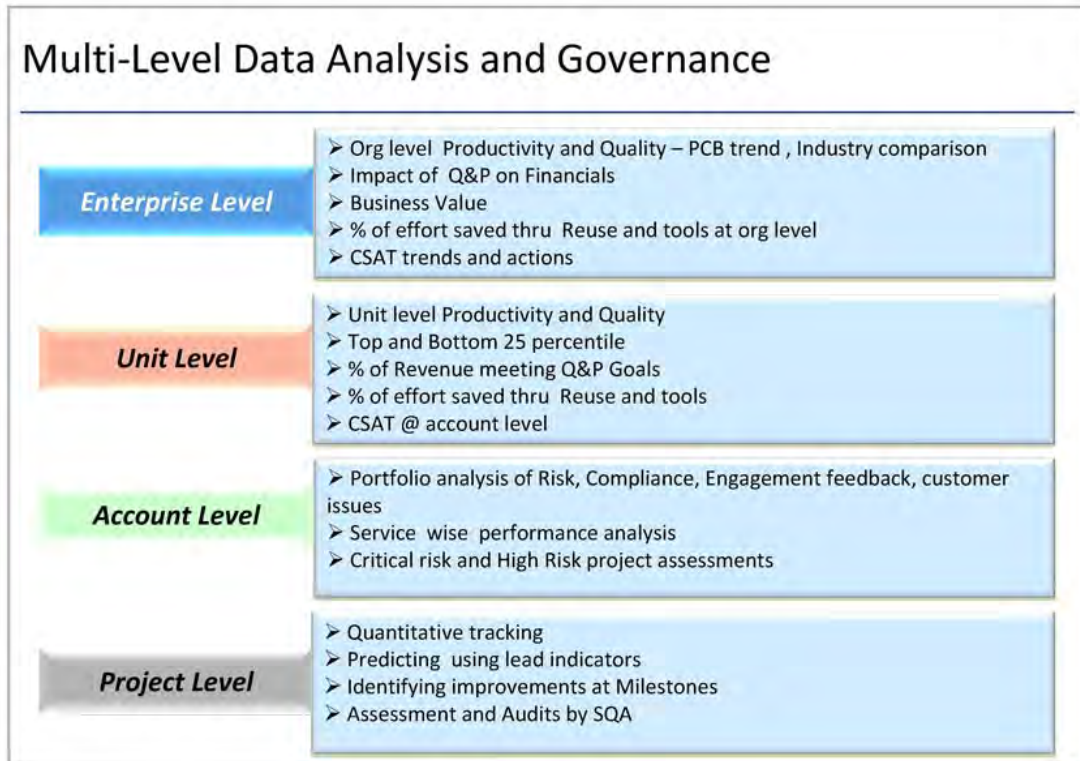
Figure 6: Multi-Level Data Analysis and Governance

Infosys has always laid great stress on managing by data. This has been demonstrated in all areas of operations: the core software process, strategic and operations planning, and other management and support processes. While performance goals and targets are set and cascaded through a goal-setting process, the data capture, analysis, retrieval, and usage are greatly enhanced through the use of multiple, elaborate systems that are controlled by the internal information systems (IS) team.

5.2 Performance Management

The selection of key metrics for the company and also for operational management down the line is driven by the overall Infosys corporate scorecard and the goal flow-down process. The Infosys corporate scorecard contains a balanced set of metrics covering financial results, customer service performance, and some of the operational parameters. The CEO owns the corporate scorecard, but

the scorecard is progressively handed off to each director and then to each business unit and department so that each scorecard represents a balanced set of metrics. The scorecards and the goals for each business group form the basis for information management at Infosys. These leading and supporting metrics are vital for planning and managing operations. The impact of the scorecards is strengthened because Infoscions can get variable company performance incentives added to their salaries. This is decided every six months after a formal review where their performance is compared to their scorecard targets.

5.3 Alignment and Integration

The goal flow-down process is strengthened by periodic reviews of each group and business unit; these reviews are performed by the BOD. In addition, each department's performance is reviewed by the management council on a quarterly or semiannual basis, and this is when dependencies and integration issues are sorted out. These reviews compare performance to the scorecard targets and help to bring in the company-wide perspective to drive the integration of goals and metrics of different groups across the company. This ensures that the benefits of synergy are leveraged. The review process ensures proper alignment of goals and targets and drives integration across groups. The link between performance appraisals and performance scorecard targets has been strengthened over the years, and now our PerforMagic system, built in-house, can set objectives and make scorecard performances available for use as references during appraisals.

The process capability baseline (PCB) for our core software processes contains the key performance data of software projects across Infosys in a summarized form. The PCB is periodically updated, and the structure of the PCB is constantly updated with changes in the services we offer and with new processes we have introduced.

5.4 Collection of Metrics

Infosys' growth has been a big challenge in several areas, including the collection of metrics. The metrics challenge is two-part: dealing with the sheer volume of metrics as Infosys grows and ensuring the accuracy and currency of the collected data. Recognizing these issues, Infosys focused on planning, building, and maintaining IT systems that can ensure that data is collected and stored during process execution to the fullest extent possible and that the data can be used later for required analyses and reports. Infosys captures, stores, and analyzes all this data through in-house IS systems that capture and retrieve data in real time.

5.5 Data as the Basis for Making Decisions

Our company-wide information network integrates all key operations and processes, enabling real-time use of data for making decisions at all levels. This is best demonstrated in the delivery department where real-time data is used for a variety of business purposes: tracking allocation of employees to different projects and business units, staffing teams based on the skill levels and visa statuses of employees, booking business for different clients, proposing solutions to new clients based on similar client problems from the past, and so on. Other departments throughout Infosys use data in similar ways.

The data rolled up to the organizational level is a vital ingredient of corporate decision making. Various types of data used extensively include trends on customers and their preferences, risk

metrics (covering key areas of our company's operations), stock market trends, employee satisfaction and attrition, customer satisfaction, complaint resolution, and so on.

5.6   Performance Analysis

Analyses are planned and conducted at different levels: at the operational level, where analysis is done by teams, and at the organizational and business levels, where required targets are revisited for modification. Infosys encourages feedback about performance from our stakeholders, as well.

Each group and business unit at the organizational level monitors and analyzes different forms of data using a plethora of tools at their disposal. These aggregated analyses are vital to senior management for their reviews and planning. At the business-unit levels, the analyses include overall revenues and revenues by customer, domain, geography, repeat business, and customer satisfaction; cost of revenues and margins; process information about deliverables to customers; and people management information, such as attrition and recruitment versus targets. At the department level, the analyses are specific to the different departments. These analyses are the basis for the business and group leaders to conduct performance reviews and planning for their groups. In addition, these analyses are used by the senior leaders to review the performance of each group. Also, departments plan their improvements using the data from the internal customer survey and the employee satisfaction survey.

In the case of software projects, there is a well-established PCB that is based on the statistical analysis of the key metrics captured in the PDB above. The PCB has the current process capability metrics for different types of projects. The quality department coordinates the analysis of organizational data and identifies process improvement opportunities. The analysis of defect data from individual projects is done at the organizational level, and the common types of defects are identified. Corrective actions are then carried out per the defect prevention methodology.

Data rolled up from different operational areas form the basis for widespread analysis at the corporate level by senior management. The analysis covers all critical business areas: financial plans, workforce plans, customer relations, and employee relations.

5.7   Information and Knowledge Management

Infosys has invested heavily in state-of-the-art information systems so that all of our employees worldwide have access to online information. Access to these systems has been integrated through Sparsh. All Infosys offices worldwide are connected through a single integrated network, with email being a vital communication tool. Infosys has deployed an extranet, which enables employees at client locations to have access to Infosys applications and knowledge sources through the internet. The IS department designs, develops, implements, and maintains our key applications.

5.8   Organizational Knowledge

The IT industry has heralded the knowledge economy and knowledge-based organizations. Infosys has a substantial competitive advantage in this business model because we continuously enhance our productivity and deliver better solutions to our clients.

At Infosys, we have a KM vision. We want to be an organization

- where every action is fully enabled by the power of knowledge

- that truly believes in leveraging knowledge for innovation

- where every employee is empowered by the knowledge of every other employee

- that is a globally respected knowledge leader

Our KM portal hosts a content-rich central repository, and our K-Shop provides access to project knowledge, or satellite repositories, across Infosys. As a window to the Internet, the K-Shop facilitates information gathering through reviewed web sites and unified, highly advanced search and navigation facilities.

The K-Shop has links to data sources that have been validated. Each satellite link to K-Shop undergoes a certification process, thus ensuring the validity of the content. If required, the KM team also reviews the documents using a workflow-based review system. This validation also rigorously checks intellectual property rights.

The application, People Knowledge Map, locates experts within Infosys who have volunteered to be knowledge resources for others. Since tapping the knowledge of employees is vital for sustaining KM, knowledge currency units (KCUs) were designed to reward and encourage experts to submit papers and volunteer on People Knowledge Map. High KCU scorers are rewarded. Infosys has also pioneered a knowledge management model (KMM), a framework to enable organizations to deploy KM practices and harness the benefits. KM is periodically assessed for deliverables through a user point rating system combined with metrics captured while the KM system is being used.

5.9 Competency Development

Infosys focuses on competency building from the day an individual enters the organization. Infosys recruited around 17,000 fresh engineers in the fiscal year of 2009. Fresh engineers go through rigorous, four-month technical and software engineering training courses, complete with hands-on exercises. For continuing education, Infoscions have access to a set of academies dedicated to technology, domain, process, project management, and behavioral learning. Over 400 people are employed in these groups. Because Infosys has a training and certification policy that mandates 10 training days and completion of two certifications in a year, these testing practices have been institutionalized over the last two years.

5.10 Research and Development

Our R&D department and our innovation unit, Software Engineering and Technology Labs (SETLabs), are at the forefront of research and are organized into various Labs and Centers of Excellence:

- The Software Engineering Lab focuses on software evolution, distributed software development, large system maintenance, software metrics, and performance engineering.

- The Digital Convergence Lab, in conjunction with the Communications, Media, and Entertainment business unit, focuses on the convergence of services, networks, and applications, including wireless sensor networks.

- The Center for Knowledge Driven Information Systems focuses on the areas of symbolic reasoning and quantitative methods for decision making, text analytics, machine learning, and task-oriented KM systems.

- The Distributed and High Performance Computing Lab focuses on computing and data optimization grids, multi-core architecture programming environments, cloud computing, and next-generation data centers.

- The Security and Privacy Lab focuses on areas such as secure application development life cycle methodology and network vulnerability.

- The Innovation Lab focuses on the use of information communication and technology to foster an environment to innovate and co-create with our clients.

- The Maintenance Center of Excellence at SETLabs focuses on the development of IP for efficient and effective preventive maintenance, transformation, and business impact of large software systems. It continues to use its platform-based, knowledge-centric, collaborative process to significantly differentiate our maintenance services and help us win large deals.

- The Microsoft Technology Center, housed within SETLabs, is an innovation incubator that fosters an environment for early technology adoption and the creation of solutions based on Microsoft (and related) technologies. The Center anchors the Catalytic IT initiative for the modernization of legacy systems. The Center has also developed collaboration tools, such as Infosys Buzz, that non-intrusively search, organize, and share information across groups within an enterprise. Another platform developed by the Center, Infosys Active Desk, is now being used to help Contact Center agents deliver a consistently superior customer service experience.

- The NVIDIA Technology Center at the Bangalore Development Center was established to develop NVIDIA CUDA™ technology-enabled software solutions.

6 Details on Key Initiatives

Some of the key initiatives and programs deployed at Infosys are enterprise reuse, Infy Swift, Infosys program management framework, product support framework, Total Integrated Development Environment, Business results impact at Infosys Technologies, Estimation Center of Excellence, Design Robustness, maintainability index, and prediction models, which all lead to better product quality.

6.1 Enterprise Reuse at Infosys

The enterprise reusable components factory was set up in 2006. Today at Infosys, the complete reuse ecosystem has been standardized and is unparalleled in the IT services industry. With 96 percent of the projects in Infosys adopting reuse and about $37 million in effort savings, Encore, Infosys' enterprise-wide component factory, has transformed the tenets of reuse to a simplified ingredient of project execution and practice. We have established standardized processes for screening, developing, and deploying components in a more seamless manner by integrating reuse into the project management system. Dashboards on relevant metrics, such as the usage of components, are published and given to delivery managers. We also established a strong rewards and recognition program for the Infoscions who participate in the reuse program, and these Infoscions are engaged through the ReForge forum, which is a collaborative development environment.

6.2 Engineer Automation Tools

The Infosys Tools Group was established in 2005. The Tools Group's unique approach ensures the standardization, licensing, and provision of dedicated tool support for projects that involve different technologies, leading to Q&P improvement and customer delight.

Table 9:   Sample Tools List for Each Stage in the Software Development Life Cycle (SDLC)

Sample Tool List for Each Stage in the SDLC	
Life Cycle Stage	**Java/J2EE**
Requirements	Rational Requisite Pro, Influx
Design	Rational Rose, Rational Software Architect, ERwin
Coding	Eclipse, Rational Application Developer, Quest TOAD, Rational Software Architect, XML Spy
PQM and Code Analysis	QA4J
Profiling and Coverage	Radien Profiler, Quest JProbe
Unit Testing	JUnit,Parasoft Jtest
IT/ST	ANT, Rational Test Manager, Rational Functional Tester, Rational Performance Tester

At Infosys, the tools group provides us with a one-stop shop for engineering tools across technologies in the organization. The team has standardized engineering tools for a large majority of our technologies, packages, and services, which has led to increased levels of automation and efficiencies across our projects. We have established standardized processes for identifying, scanning, and evaluating tools; developing in-house utilities; and deploying standard tools throughout the organization in a more seamless manner. This has been accomplished by integrating the tools group with the project management system, which has helped us in every stage of tool deployment.

Dashboards on tool usage (and other relevant metrics) are published to delivery teams at regular intervals. Training on tools is available to all eligible employees through various mechanisms like classroom sessions, e-learning collateral, web-based demos, and so on. Engineering tools are now a part of the foundation program and other extensive training programs and certifications. Our extended network of over 1,000 tool coordinators, tool subject matter experts (SMEs), and unit-level anchors engage our delivery units across Infosys. The tools group actively connects with various stakeholders within our organization through innovative communication campaigns, awareness initiatives, and forums like the Software Tools Conference, enabling series, and bi-monthly newsletters. Collaboration with our stakeholders, vendors, and partner groups helps the tools group reach out to a large number of project teams, so they can keep constant tabs on new developments on the tools and technology front.

The team has evaluated a huge set of tools across various technologies, and tools have been standardized for a large majority of these technologies. Tool-enabling programs across our organization have ensured that a significant percentage of Infoscions are equipped for efficient tool use in their projects, and project teams consult with the tool group on their teams' tool use. Because the tool group continuously tracks and measures our organization's tool use, automation and tool usage have become an integral part of our software delivery process.

6.3   Infy Swift

Infy Swift is a proven methodology for the GDM-enabled short-cycle delivery approach. It is a feasible way of executing agile projects in a distributed development environment with a high amount of predictability, using defined processes, tools, and engineering practices. Use of the Infy Swift methodology results in reduced cycle time, early visibility, faster return on investment, and, most importantly, team motivation.
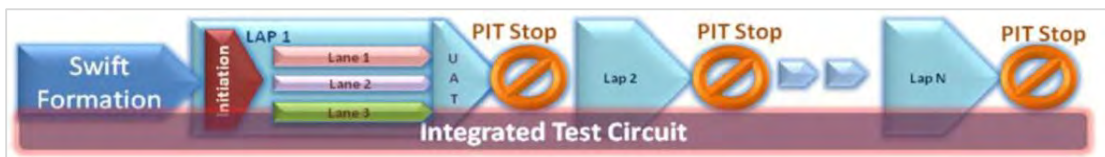

Figure 7:   Infy Swift Life Cycle Depiction

Business benefits brought about by the implementation of Infy Swift are
- better orchestration of business and IT teams
  - clear and robust requirements change management process
  - systematic collaboration with clients and teams

- early engagement of Infosys with client business teams

- increasing competitiveness of Infosys

- early visibility into the product being built, efficient feedback, and improved client satisfaction

- paradigm shift from a micromanaged vendor to a trusted partner

Infosys has responded to current market needs in a more responsive way and filled gaps in the existing approaches through Infy Swift-accelerated development methodology. This methodology suits Infosys' needs and clients and helps us achieve early realization of business value with high predictability and a reduced cycle time, as seen in Figure 7. Infy Swift was able to be adapted to the current recession when budgets need to be flexible. As more and more customers are adopting agile, lean, and other new methodologies, Infy Swift is sure to stand out as a unique choice from Infosys.

6.4 Infosys Program Management Framework

The objective of TRANSCEED, the Infosys program management framework, is to strengthen our program management capabilities by comprehensively addressing processes, systems, and people dimensions. It provides the necessary framework and methodology, integrated systems and tools, competency development, career stream, and ecosystem to help improve customer experience, predictability, and de-risking.
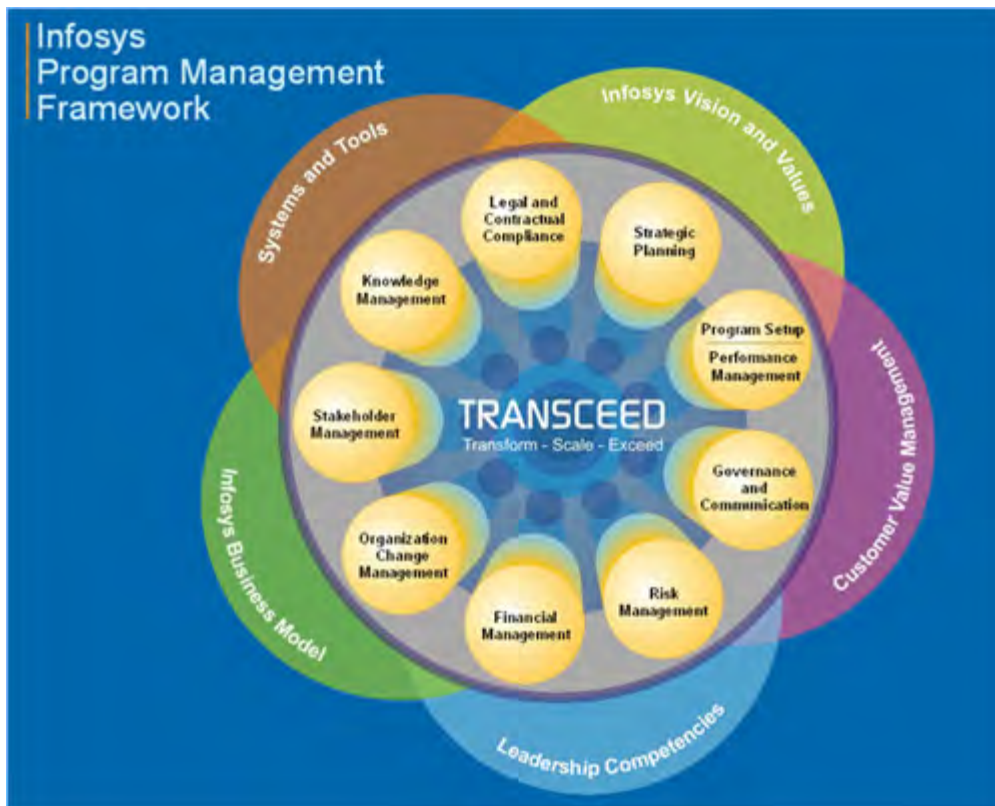

Figure 8:   Infosys Program Management Framework

TRANSCEED, shown in Figure 8, is a comprehensive framework aimed at successfully managing large programs. It is composed of nine core process areas and is influenced by five common themes. It provides a detailed methodology, including work flow and process aids like templates, checklists, and artifacts for program management. It is based on the standard Infosys process definition framework and provides well-defined life cycle phases of program management.

TRANSCEED has been benchmarked against industry standards, like the Organizational Project Management Maturity Model[8] (OPM3), and it has been gauged on program management resources from the Office of Government Commerce, UK (OGC). TRANSCEED provides an integrated program management system and tools that are workflow-based. It is integrated with order to remittance (OTR) systems and IPM+ engineering tools. SMEs from various units collaborated with the senior management and the BOD to develop TRANSCEED.

6.5 Product Support Framework

PROSPER is the Infosys production support framework that gives process guidance and support during due diligence, transition, and steady state. (See Figure 9.)
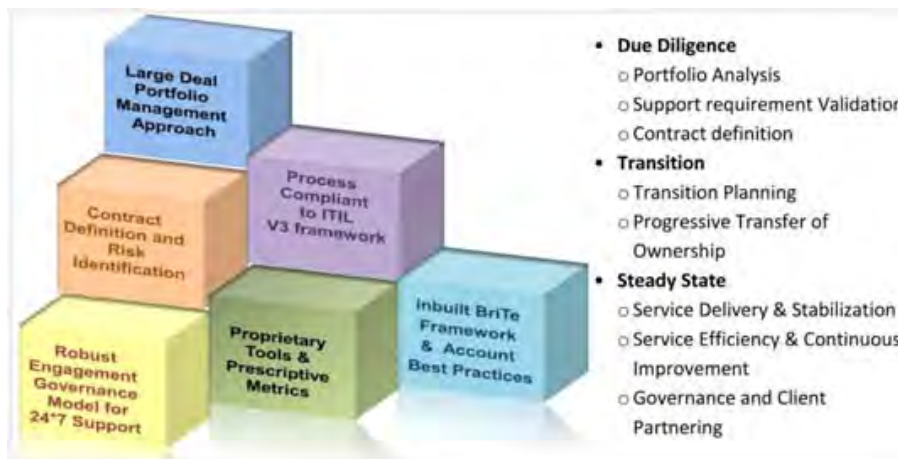
Figure 9: Elements of Infosys Production Support Process

6.6 Total Integrated Development Environment

To take the success of enterprise tools, reusable components, and methodologies to the next level, Infosys created the Total Integrated Development Environment (TIDE). TIDE, an Infosys proprietary methodology, integrates engineering life cycle tools, technical and business components, and specific delivery process and methodology by using an integration bus in service-oriented architecture. Usage of this in specific .NET-based technologies has resulted in a 12 percent improvement.

---

[8]   OPM3, OPM3 ProductSuite, and Organizational Project Management Maturity Model are trademarks of the Project Management Institute, Inc. registered in the United States and other nations.

6.7 Business Results Impact at Infosys Technologies

The Infosys Brite methodology, our trademarked improvement process, is based on Six Sigma and lean principles. The Infosys Brite program has rapidly expanded its footprint from covering small project-level improvements to covering units around twenty-times that size since its inception. The Infosys Brite methodology is applied to projects, regardless of the service type or domain, exhibiting its integration capability. While there is a central pool of Infosys Brite SMEs, Infosys has put together a team of certified experts from the delivery team.

i-Trim is an Infosys improvement solution that focuses on eliminating activities that do not add value or optimize process performance. Using i-Trim, we can address business and operational challenges that impact stakeholder growth and profitability. i-Trim is about eliminating inefficiencies, simplifying processes, and speeding up deliverables.

6.8 Estimation Center of Excellence

Across the IT industry, accurately estimating efforts and schedules still continues to be a huge challenge. More accurate estimates lead to higher proposal conversion rates and better operating margins. The Estimation Center of Excellence (Infosys Esteem) at Infosys has standardized estimates and sizing methods for various service lines of Infosys, as seen in Table 10. Patented estimation methods include package points for packaged implementation and test case points for testing services, data warehousing, and development services.

Table 10: Scientific Estimation Coverage by Service Line

Service Line	Sizing Estimation Model Adopted
Development and reengineering	Function points model from International Function Points Users Group (IFPUG)
Maintenance enhancements	Function points models from IFPUG-Netherlands Software Metrieken Gebruikers (NESMA)
IT support	Full-time equivalent (FTE) estimation model*
Testing	Test points model*
Package implementation	Package points model* (filed for IP)
Data warehouse & portal development	Customized form of FP estimation model for IFPUG*
Enterprise architecture implementation	Enterprise Application Integration (EAI) estimation model*
Product engineering	COSMIC Full Function Points

* Internally developed sizing models

6.9   Design Robustness and the Maintainability Index

The maintainability index (MI) model was developed at Infosys to measure the quality of code. Controlled experiments showed that the robustness of the design of the MI model contributed to higher maintainability of code. Design Robustness (DesignR) is an indigenous, first-of-its-kind, innovative methodology and an IP of Infosys that measures the quality of object-oriented design in terms of defect proneness (DP) and change proneness (CP). DP indicates classes that have a higher probability of defects, and CP indicates classes that have a higher effort impact of changes. DesignR can be used in both the design and coding phases. Both the models use a linear combination of various metrics to measure the quality rather than just individual metrics because it is very difficult for all classes in an application to adhere to all specific metrics.

A study of MI versus cost of poor quality (COPQ) indicates that the higher the percentage of classes in an application meeting MI, the higher the odds of achieving better COPQ. Also, as the percentage of classes meeting MI goes higher in the application, the percentage of projects having better COPQ further improves.
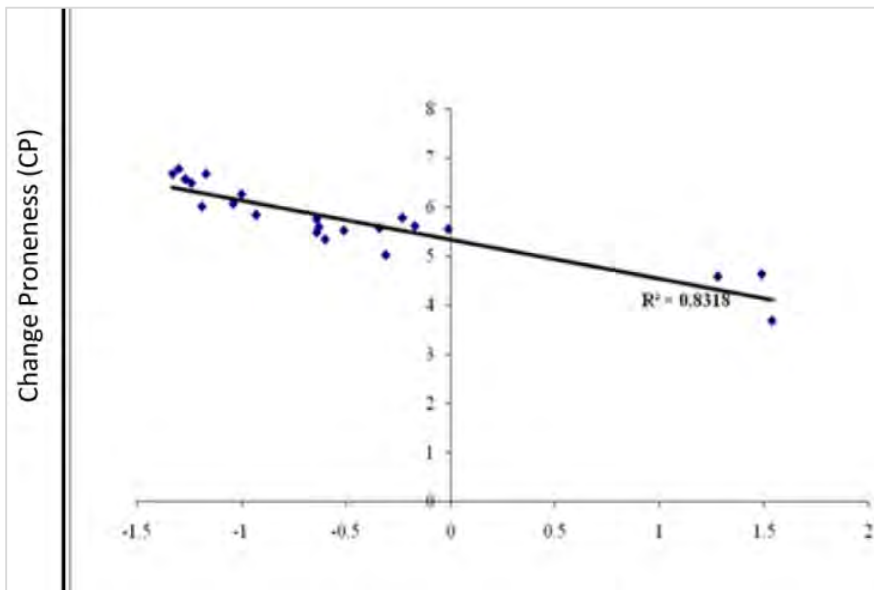
Figure 10: Change Proneness Versus Maintainability Index

6.10   Prediction Models

High maturity is characterized by quantitative predictions across the life cycle stages. Figure 11 gives the process performance models (PPMs) being used at Infosys. We discussed these with the high maturity committee working on CMMI V1.3 at the Carnegie Mellon University Software Engineering Institute (SEI).We have filed a patent application for PROSO, our project scheduling model. Similarly, for other services, like maintenance and support, models for predicting aspects, like ticket arrival and service level agreements (SLAs), are available.
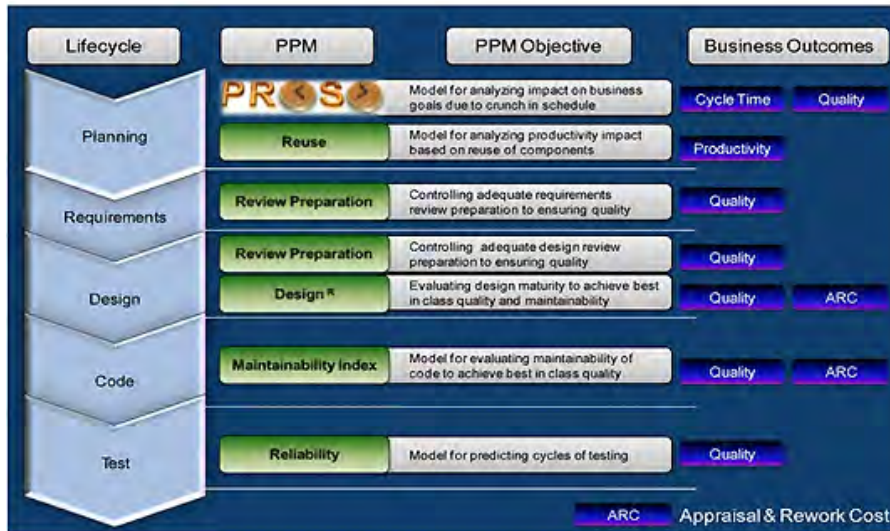
Figure 11: Process Performance Models by Software Development Life Cycle Stage

6.11 Better Product Quality

For the past five years, Infosys has increasingly monitored our product quality during the design and coding phases. We have even developed a tool, QA4J, that effectively measures the quality metrics during these phases. The MI and DesignR are models developed based on these metrics. Infosys has rolled out these metrics for Java, .NET, COBOL, and C. Among the projects in these technologies, deployment is around 70 percent.

7 Results

Infosys has a record of completing 99 percent of our projects on or before schedule, and we delivered within +/- 10 percent of budgeted effort 98 percent of the time. This superior operational excellence resulted in a 50 percent increase in overall customer experience scores in 2009. This is especially good news during a time of recession in the global economy. An achievement of this magnitude can be attributed to our business excellence framework, processes based on industry standards, integrated systems for delivery, superior engineering capability, comprehensive people enablement, and value-based customer-centric planning and execution.

In the last five years, there has been a new wave of outsourcing and a paradigm shift in client expectation. With the increase in outsourcing of critical business processes and the setup of active captive units for cost effectiveness, the expectations for IT services organizations has changed from being IT implementers to becoming trusted advisors for providing business values. The creation of vendor management offices for clients resulted in stricter vendor evaluation mechanisms and contractual structures involving a risk-reward framework. Infosys set aggressive targets to partner with clients and rapidly

- scaled up (50 percent compound annual growth rate revenue in five years)
- introduced six new services and engagement models
- grew from under 30,000 to over 100,000 employees of 50+ nationalities and 600+ customers worldwide

Our integrated process ecosystem, effective measurements and governance, strong enabling mechanisms, and our focus on robust software engineering provide a powerful foundation for the continued value we deliver to our clients.

Key results of our software process improvement program over the last five years include the following:

- Our overall productivity trend continuously improves, showing a 14 percent improvement in 2009 (annualized).
- We completed 99 percent of our projects on or before schedule.
- We delivered within +/- 10 percent of budgeted effort 98 percent of the time.
- Because of our process improvement, we improved 200 basis points on our bottom line.
- Our customer experience score continues to improve. Our average engagement feedback score is 6.2 out of 7, and we score 7 out of 7 on many sub-parameters.

The fiscal year of 2008–09 was a tough one for the IT services industry. However, Infosys was able to attract new clients, retain current ones, improve revenue beyond guidance, improve margins, and, most importantly, increase customer satisfaction. In our annual customer satisfaction survey, managed by a third party, we received improved ratings for customer experience, value for money, advocacy, and so on. In summary, the quality team at Infosys has been able to demonstrate significant achievements in its software processes in the last five years.

7.1 Recent Awards

Customers and others in the IT industry continuously commend the success of our business model, recognizing our delivery capabilities. The following are some of the awards we have recently received:

2008–09

- Vantage Partners and the Outsourcing Institute's first ever Customer Relationship Management award [Vantage 2009]
- MAKE award for excellence in knowledge management through content sharing, collaboration, and professional networking [KNOW 2009]
- Hitachi Data Systems Diamond Award for Best Virtualization Strategy and the Platinum Award for Best Green Strategy for a Data Center [Hitachi 2009]
- Banker Technology Award from The Banker [Infosys 2009]
- Sears Holdings Corporation, Partner in Progress, second consecutive year [Outsource 2009]
- ranked number 3 on the International Association of Outsourcing Professionals (IAOP) 2008 Global Outsourcing 100 list [IAOP 2008]

2006–08

- Gold Boeing Performance Excellence Award (BPEA) from the Boeing Company [Boeing 2007]
- Royal Bank of Scotland Group's Best Technology Supplier from 2007 [Infosys 2007a]
- Global Preferred Vendor from Information Technology for Cummins, Inc. [Cummins 2008]
- Supplier Excellence Award from Eastman Chemical, second consecutive year [DMN 2007]
- National Outsourcing Association Award for Innovative Outsourcing Project of the Year 2007, along with our customer British Telecom [SiliconIndia 2007]
- Sears Holding Corporation, Partner in Progress Award [Techwhack 2008]
- Daimler Chrysler's IPS Supplier of the Year 2006 [Newswatch 2007]
- Sainsbury's 2006 IT Supplier of the Year [Infosys 2007b]

Acronym List

ADM
application development maintenance

AS
Aerospace

BCP
business continuity plan

BOD
board of directors

BPEA
Boeing Performance Excellence Award

BPO
business process outsourcing

BS
British Standards

CMM
Capability Maturity Model

CMMI
Capability Maturity Model Integrated

COPQ
cost of poor quality

CP
change proneness

CSAT
Infosys annual customer service satisfaction survey

DC
development center

DesignR
Design Robustness

DP
defect proneness

DR
disaster recovery

EC
executive council

FP
function point

GDM
global delivery method

IAOP
International Association of Outsourcing Professionals

IFPUG
International Function Points Users Group

ILI
Infosys Leadership Institute

ILS
Infosys Leadership System

IMS
infrastructure management services

Infosys Brite
Business results impact at Infosys Technologies

Infosys Esteem
Estimation Center of Excellence

INSIGHT
integrated audit system

IP
intellectual property

IPM+
Integrated Project Management Suite

IPR
intellectual property rights

IS
information system

ISO
International Organization for Standardization

iSOP
Infosys Scaling Outstanding Performance

IT
information technology

KCU
knowledge currency units

KM
knowledge management

KMM
knowledge management model

MAKE
Most Admired Knowledge Enterprise

MC
management council

MI
maintainability index

NESMA
Netherlands Software Metrieken Gebruikers

OGC
Office of Government Commerce, UK

OPM3
Organizational Project Management Maturity Model

PCB
process capability baseline

PDB
process database

PPMs
process performance models

PRiDE
Process Repository at Infosys for Driving Excellence

PROSO
Infosys project scheduling model

PROSPER
Infosys production support methodology

Q&P
quality and productivity

R&D
research and development

SaaS
software as a service

SDLC
software development life cycle

SEI
Carnegie Mellon University Software Engineering Institute

SLAs
service level agreements

SME
subject matter expert

STC
Society for Technical Communication

STRAP
Infosys annual business plan

TIDE
Total Integrated Delivery Environment

TRANSCEED
Infosys program management framework

References

URLs are valid as of the publication date of this document.

[Boeing 2007]
Boeing. *2007 Recipients*. http://www.boeingsuppliers.com/supplier_portal/2007_win.html (2007).

[Cansfield 2009]
Cansfield, Mike; Daley, Ellen; and Ashour, Madiha. *Farewell to the Traditional Telecom Ecosystem: How Vendor Strategists Can Win with Customer-Led Ecosystems*.
http://www.forrester.com/rb/Research/farewell_to_traditional_telecom_ecosystem/q/id/46829/t/2 (2009). Login required.

[Cecere 2009]
Cecere, Marc. *Forrester Wave™: IT Organization Redesign Consultancies* (Q1 2009).
http://www.forrester.com/rb/Research/wave&trade%3B_it_organization_redesign_consultancies, _q1_2009/q/id/44941/t/2 (2009). Login required.

[CIO 2009]
CIO. *The 2009 CIO 100 Winners: Driving future Business Growth with Technology Innovation*.
http://www.cio.com/cio100/2009/1 (2009).

[Cummins 2008]
Cummins, Inc. *Cummins Inc. Selects Infosys Technologies as a Global Preferred Vendor for Information Technology*. http://goliath.ecnext.com/coms2/gi_0199-7556063/Cummins-Inc-Selects-Infosys-Technologies.html (2008).

[DMN 2007]
DMN News. *Infosys Technologies Limited Wins Eastman Chemical Company's Supplier Excellence Award*. http://forums.digitalmedianet.com/cgi-bin/displaywwugpost.fcgi?forum=dmn_news&post=070804102536.htm (2007).

[Fortune 2009]
Fortune Magazine. *100 Fastest-Growing Companies*.
http://money.cnn.com/magazines/fortune/fortunefastestgrowing/2009/index.html (2009).

[Great 2009]
Great Place to Work. *India's Best Companies to Work For: 2009*.
http://www.greatplacetowork.in/best/list-in-special-categories-2009.php (2009).

[Hay Group 2009]
Hay Group. *The Best Companies for Leaders to Demonstrate How to Weather Economic Storms and Prepare for the Upturn*. http://www.haygroup.com/ww/press/Details.aspx?ID=10924 (2009).

[Hitachi 2009]
Hitachi Data Systems. *Inspiration Awards: Results 2009*.
http://hdsitinspirationawards2010.todayir.com/html/results_09.php (2009).

[Hopperman 2009]
Hopperman, Jost; Leganza, Gene; An, Mimi; and Czarnecki, Matt. *Forrester Wave™: Global Banking Platform* (Q1 2009).
http://www.forrester.com/rb/Research/wave%26trade%3B_global_banking_platforms%2C_q1_2 009/q/id/45621/t/2 (2009). Login required.

[Infosys 2007a]
Infosys. *Infosys Named Royal Bank of Scotland Group's 2007 "Best Technology Supplier."*
http://www.infosys.com/newsroom/press-releases/Pages/royal-bank-scotland.aspx (2007).

[Infosys 2007b]
Infosys. *Infosys Named Sainsbury's 2006 IT Supplier of the Year*.
http://www.infosys.com/newsroom/press-releases/Pages/sainsburys-2006-IT-supplier.aspx (2007).

[Infosys 2009]
Infosys. *Infosys Technologies is Presented with Two Awards by The Banker Technology Awards for its Exceptional Work in Wholesale and Capital Markets*.
http://www.infosys.com/newsroom/press-releases/Pages/banker-technology-awards.aspx (2009).

[IAOP 2008]
International Association of Outsourcing Professionals. *The 2008 Global Outsourcing 100*.
http://www.iaop.org/content/23/152/1619/ (2008).

[Jana 2009]
Jana, Reena. *Is Innovation Too Costly in Hard Times? BusinessWeek's List of the World's Most Innovative Companies Shows Not All Are Reining in R&D*.
http://www.businessweek.com/magazine/content/09_16/b4127046252968.htm?chan=magazine+c hannel_in%3A+inside+innovation (2009).

[Juniper 2009]
Juniper, Charles. *Targeting U.S. Healthcare Payer BPO*. http://www.nelson-hall.com/programs/insurance-sourcing/market-analyses/browse-latest-healthcare-insurance-market-analyses-by-title.html?avpage-views=article&id=65634&fv=1 (2009).

[KNOW 2009]
The KNOW Network. *Most Admired Knowledge Enterprises*.
http://www.knowledgebusiness.com/knowledgebusiness/templates/TextAndLinksList.aspx?siteId =1&menuItemId=31 (2009).

[Marriot 2008]
Marriot, Ian; Tramacere, Gianluca; Young, Allie; Huntley, Helen; Iyengar, Partha; and Roy, Arup. *Magic Quadrant for European Offshore Application Services* (G00161624). RAS Core Research, Gartner, 2008. www-935.ibm.com/services/in/gbs/app/pdf/article4.pdf

[McNeill 2009]
McNeill, Robert and McNee, Bill. *India's Big Guns Set Their Sights on SaaS and the Cloud*. http://saugatucktechnology.com/Browse-Research/551MKT-Indias-Big-Guns-Set-Their-Sights-On-SaaS-And-The-Cloud-60/View-details.html (2009). Login required.

[Newswatch 2007]
Newswatch. *Infosys Awarded DaimlerChrysler's "IPS Supplier of the Year 2006."* http://www.businessgyan.com/node/2658 (2007).

[Outsource 2009]
Outsource Portfolio. *Infosys Named as a Top Supplier for Sears*. http://outsourceportfolio.com/infosys-named-top-supplier-sears/ (2009).

[Reputation 2009]
Reputation Institute. *2009 Global Reputation Pulse: The World's Most Reputable Companies: The Global Section*. http://www.slideshare.net/jasoncronkhite/reputation-institutes-2009-global-reputation-pulse-free (2009).

[Roehrig 2009]
Roehrig, Paul. *The Forrester Wave™: Global IT Infrastructure Outsourcing* (Q1 2009). http://www.forrester.com/rb/Research/wave%26trade%3B_global_it_infrastructure_outsourcing%2C_q1_2009/q/id/46852/t/2 (2009). Login required.

[Sheedy 2009]
Sheedy, Tim. *The Forrester Wave™: North American SOA Systems Integrators* (Q2 2009). http://www.forrester.com/rb/Research/wave&trade%3B_north_american_soa_systems_integrators,_q2/q/id/46713/t/2 (2009). Login required.

[Sheth 2009]
Sheth, Niraj. *Infosys Prevails as Storm Brews in India's Tech Sector*. http://online.wsj.com/article/SB125017981772929505.html (2009).

[SiliconIndia 2007]
SiliconIndia. *BT and Infosys awarded NOA's Innovative Outsourcing Project of the Year*. http://www.siliconindia.com/shownews/BT_and_Infosys_awarded_NOAs_Innovative_Outsourcing_Project_of_the_Year-nid-37339.html (2007).

[Tan 2009]
Tan, Susan and Sholler, Daniel. *MarketScope for SOA C&SI Services, North America, 2009*. http://www.gartner.com/DisplayDocument?doc_cd=169347 (2009).

[Techwhack 2008]
Techwhack. *Infosys Technologies Named as a Top Supplier for Sears Holding Corporation*. http://press-releases.techwhack.com/22720-sears-holdings-corporation (2008).

[Vantage 2009]

Vantage Partners. *Vantage Partners and The Outsourcing Institute Announce Winners of the Second Annual Outsourcing Relationship Management "RMMY" Awards.* http://vantagepartners.com/2009_RMMY_Awards.aspx (2009).

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, search-ing existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regard-ing this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.

1. AGENCY USE ONLY (Leave Blank)	2. REPORT DATE March 2011	3. REPORT TYPE AND DATES COVERED Final

4. TITLE AND SUBTITLE IEEE Computer Society/Software Engineering Institute Software Process Achievement (SPA) Award 2009	5. FUNDING NUMBERS FA8721-05-C-0003

6. AUTHOR(S)

Satyendra Kumar and Ramakrishnan M.

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Software Engineering Institute Carnegie Mellon University Pittsburgh, PA 15213	8. PERFORMING ORGANIZATION REPORT NUMBER CMU/SEI-2011-TR-008

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) HQ ESC/XPK 5 Eglin Street Hanscom AFB, MA 01731-2116	10. SPONSORING/MONITORING AGENCY REPORT NUMBER ESC-TR-2011-008

11. SUPPLEMENTARY NOTES

12A DISTRIBUTION/AVAILABILITY STATEMENT Unclassified/Unlimited, DTIC, NTIS	12B DISTRIBUTION CODE

13. ABSTRACT (MAXIMUM 200 WORDS)

Infosys Technologies Limited received the IEEE Computer Society/Software Engineering Institute Software Process Achievement (SPA) Award 2009 for establishing a cost-effective, sustained, and culturally integrated quality and productivity improvement program during a period of extraordinary corporate growth. For more information regarding the IEEE Computer Society/Software Engineering Institute Software Process Achievement (SPA) Award, visit http://www.computer.org/portal/web/awards/technical.

14. SUBJECT TERMS SPA Award, Infosys, software process, information technology, outsourcing, corporate growth	15. NUMBER OF PAGES 54

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT Unclassified	18. SECURITY CLASSIFICATION OF THIS PAGE Unclassified	19. SECURITY CLASSIFICATION OF ABSTRACT Unclassified	20. LIMITATION OF ABSTRACT UL

NSN 7540-01-280-5500

Standard Form 298 (Rev. 2-89) Prescribed by ANSI Std. Z39-18
298-102