

BUILDING YOUR INFORMATION SYSTEMS FROM THE OTHER SIDE OF THE WORLD: HOW INFOSYS MANAGES TIME ZONE DIFFERENCES¹

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Executive Summary

We often hear that global IT work creates difficulties due to time and distance. Companies source their IT work to Asia to capitalize on lower labor costs. But they soon discover time zone coordination costs that stem from delayed communications and misunderstood tasks. We also hear a conflicting claim that time zone differences are actually an advantage in global IT work because a project can work round-the-clock. Are time zone differences good or bad? And how do companies overcome the challenges? This article explores this topic using the case of India-based Infosys, now one of the world's largest IT sourcing and services firms.

A clock framework with 10 time-zone solutions is used to summarize relevant practices. The 10 solutions fall into three groupings: a 24-hour organizational culture; process and technology; and a liaison, who encompasses elements from both process and culture. The Infosys case demonstrates a balance between organizational culture solutions and process solutions. Importantly, Infosys has nurtured an organizational culture in which employees see themselves in a global firm covering 24 time zones. "When the [young software engineers] choose IT as a career, everyone knows about the need to work over time differences." One of the solutions, the liaison, is called the onsite coordinator at Infosys. This person bridges the client site and the India-based engineering staff. An advantage of time zone differences is follow-the-sun work. But at Infosys, it is used infrequently.

TIME ZONE DIFFERENCES, GOOD OR BAD?

Time zone differences have produced confusion in today's global sourcing era: are they good or bad? For CIOs in North America or Europe, offshoring means crossing many time zones.³ A recent McKinsey-Nasscom report estimates that India's offshoring industry will reach \$60 billion by 2010.⁴ Companies source their IT work offshore to India (and other Asian locations) because of lower labor costs. But they soon come to realize that time zone differences introduce

additional coordination costs that negate some of the labor savings.

If there is a firm that is likely to have insights about the time zone gap, it is a firm such as Infosys. Infosys is one of the largest and most successful Indian-based IT professional services firms. It is a pioneer in global systems development, now known as offshoring. Much of its IT work is performed for customers in North America.

A Brief History of Time Zones

We have been living with time zones for just over one century. Standardization of time and time zones based on the Greenwich Mean Time (GMT) was first formalized in 1884. Today, time standardization is commonly referred to as Universal Time, abbreviated as UTC. One of the early industrial benefits of international time standardization was that it allowed railroad schedules to be synchronized. Today, airplane schedules would be impossible without the standardization of UTC.

Nevertheless, time zones are cumbersome for synchronization and coordination because people must adjust the time to the location. Therefore, at the

¹ Jeanne Ross was the accepting Senior Editor for this article.

² My appreciation to Infosys for opening its doors to this research study. A number of Infosysians took time and assisted this research, in particular Deependra Moitra; also, Jai Ganesh, and Manohar Murthy. Many others gave of their time and this is appreciated. Helpful comments to this paper came from Peter Schumacher, Bill DeLone, Gwanhoo Lee, Sally Fowler, and Alberto Espinosa. My thanks also for the constructive editorial comments from Jeanne Ross and Cynthia Beath.

³ In contrast, "nearshore" locations, such as Brazil, stress to their clients that they are located in the same or a nearby time zone.

⁴ This estimate includes IT and all IT-enabled services and comes from Ribeiro, J., "India's Outsourcing Valued at \$60B by 2010," *Computerworld*, December 12, 2005, http://www.computerworld.com/managementtopics/outsourcing/story/0,10801,107009,00.html?source=NLT_XSP&nid=107009, Accessed January 10, 2006.

dawn of the Internet Age, an interesting initiative was conceived to address the new realities of coordination.⁵ In 1998, the watch company Swatch introduced a new time standard, called “Internet Time,” with no time zones at all. Everyplace in the world was at the same time, making coordination much simpler. Time was measured in “beats;” with 1,000 beats per day (a beat was about 1.5 minutes). Mid-day was represented as @500 and it occurred at the same moment all over the world.⁶ As we know, Internet Time did not catch on, even though it would have simplified coordination for software engineers at Infosys.

The Coordination Costs of Time Zone Differences

Until the 1980s, coordinating distributed knowledge work was affected little by time zone differences. But the diffusion of fax machines began to change that. Until the fax machine, most work products could not be transferred instantly across time zones. Instead, computer tapes, or printed pages, were sent by air delivery. Collaboration was, at best, *loosely coupled*. While time zone differences had little impact, *distance* was critical because of shipping times and costs. Today, the situation has reversed itself: shipping digital goods is essentially free (the variable cost is zero) and instantaneous. But time differences have become the principal obstacle to efficient coordination.⁷ In fact, in recent decades, coordination across time zones has become a greater problem, not a diminishing one.

The deeper problem of time zone gaps is that, in some cases, it is *inherently not solvable*. Human beings work during the daylight hours due to deeply embedded biological and societal norms. Once the number of time zones between collaborators is larger than eight hours, then the time zone gap is not solvable. While one programmer is working, the other programmer, with whom coordination is needed, is asleep. Video-conferencing cannot overcome this fundamental problem, no matter how high its pixel density. The time zone problem can be mitigated, as will be discussed later, but it cannot be eradicated.

Coordination problems may appear rather mundane at first. Since real-time dialogue is difficult across large time zone differences, many e-mail messages are actually requests for clarification in the form of “Can you explain or clarify this for me, please...?” Without

clarification, one person is stuck. Worse, in many cases the first clarification is insufficient. Meanwhile, several days have gone by.

When coordination breaks down, work often has to stop. Take, for example, the common type of global IT work called “production support.” An offshore software engineer is assigned a defect to fix. But at 09:30 India Standard Time, he cannot re-create the defect based on what is logged into the issue/defect system. The author of the defect report, 10.5 time zones away, has gone home for the day. So the offshore software engineer resorts to writing an e-mail requesting clarification. Solving the problem is delayed by one day, at least.

Figure 1: Components of coordination costs caused by time zone differences.⁸

1. Delay costs—The costs incurred because one node is waiting for another to begin the work day. Often, the delay is a compounded delay because the prior communications, which were asynchronous, were unclear.
2. Rework costs—When understanding does not take place (due to problems of asynchronous communication), one node makes errors that need to be fixed. Rework costs are the production costs of fixing the error.
3. Set-up costs—The costs for individuals to re-learn a task that was deferred or delayed.

Let us summarize the implications of these issues on the costs of coordination. Each location is a node that has one or more individuals. A coordination cost is incurred to synchronize nodes’ activities when there is some *dependency* between them. When there is no dependency, then coordination is not required and there are no coordination costs. Figure 1 introduces three theory-based coordination cost components. The most important is *delay*.⁹

8 Coordination theory was developed by Tom Malone and described in Malone, T., “Modeling Coordination in Organizations and Markets,” *Management Science* (33:10), 1987, pp. 1317–1332. Espinosa and Carmel adapted this theory and developed it for time zone differences in Espinosa, A. and Carmel, E., “The Impact of Time Separation on Coordination in Global Software Teams: a Conceptual Foundation,” *Journal of Software Process Improvement and Practice*, (8:4), 2004. Figure 1 is a further adaptation of that work.

9 While the first two cost components in Figure 1 assume only a one-task dependency between the nodes, the third, set-up, introduces multi-tasking. When waiting for a clarification, the software engineer has no choice but to remain busy. Therefore, he or she has to switch contexts and begin a new task. Later, after receiving the clarification response, the engineer must again switch contexts. Each time this happens, there are start-up costs in re-absorbing the task at hand. Set-up costs are familiar in manufacturing when switching between production runs.

5 Heejin, L. and Liebenau, J., “Time and the Internet at the Turn of the Millennium,” *Time & Society*, (9:1), Mar 2000, pp. 43–56.

6 In Internet Time, @500 is half a day after midnight in Switzerland, home of Swatch. @500 is late afternoon in India and time to go to sleep in Sydney.

7 By coordination, we mean the act of integrating each task and organizational unit so that it contributes to the overall objective.

Coordination costs are also affected by the absolute difference in time zones. Specifically, coordination costs generally increase as the time zone gap increases because fewer workday hours overlap, so there is less time to hold synchronous conversations.¹⁰ In other words, if it were possible to hold all other coordination problems constant (culture, language, travel, etc.), then coordination costs are higher when the locations are eight time zones apart than when the locations are only one time zone apart.¹¹ Of course, even when collaborators are sitting next to each other, coordination costs are still not zero.

Why do companies send their work offshore despite these higher coordination costs? In general, the lower labor costs wash away these extra costs. Labor costs in India are more than 50% lower than those in the U.S. And, as we shall see, offshore providers do a reasonable job at controlling the coordination costs due to time zone differences (as well as the extra costs of cultural differences, knowledge transfer, risk mitigation, and other extra offshore costs).¹²

CASE STUDY: INFOSYS

Infosys was founded in Bangalore in 1981. By the 1990s, it had established itself as one of the most admired and respected companies in India. It is one of the big three Indian IT service providers, together with Wipro and Tata Consultancy Services. In 2005 (the time of this case), Infosys had 30,000 employees and revenues exceeding \$1 billion. It had a spectacular decade-long run of annual growth rates usually exceeding 30% while maintaining net profits in the 20-40% range. Infosys first traded on the Bombay Stock Exchange in 1993, and on the U.S.-based NASDAQ in 1999.

Only a small portion of Infosys' revenues comes from domestic sales in India. Infosys is fundamentally an exporting firm, and one with global reach. In 2005

, Infosys had 18 development centers, including three in North America.¹³ Strategically, Infosys began branching out from IT services in the early 2000s by establishing: a consulting arm, an IT enabled services unit (called Progeon), a contract software R&D unit, as well as an internal research unit (the Software Engineering and Technology Labs).

The company is recognized for its impressive Bangalore campus, which covers 30 hectares. The campus has over two million square feet of office space, including several dozen office buildings and a recently completed hotel and conference center. The striking global conferencing center that resembles a space center is shown in many documentaries about India. Infosys is considered a highly desirable place to work—among India's best. It was awarded the prize of being India's best employer in 2001, 2002, and 2005 by Hewitt Associates. It was also the first Indian firm to offer stock options to all qualified employees.

Infosys' Global Delivery Model (GDM)

Infosys coined the term Global Delivery Model (GDM) in the late 1980s to explain how this upstart Indian company, halfway around the world, could conduct quality delivery from so far away from the U.S.

GDM came about as a reaction to the common Indian companies' practices of the day. Most Indian firms were trying to keep as many Indian engineers as possible on site at American locations. In this "body shopping" model, the Indian firms were essentially acting as intermediaries for inexpensive foreign labor.

During that period, Infosys changed its strategy to have more of the project staff stay offshore in India. To do so, though, it had to develop a professional IT services organization to deliver services—and to do so from afar. Accordingly, Infosys put into motion three far-sighted policies. First, it improved its process maturity by embracing the American-developed methodology of the Capability Maturity Model (CMM). Indeed, by 1999, Infosys was one of the first organizations in the world to attain CMM Level 5, the highest process maturity level. Second, Infosys refined its home-grown GDM to address the needs of distance that CMM did not. Third, Infosys developed and cultivated its self-contained, showcase campus to be a comfortable place to work, even after hours.

GDM is a rather loose model that encompasses the concepts of task allocation, project structure, and

10 Distance also reduces the chances of spontaneous communication to solve coordination issues, as was first shown in Tom Allen's seminal research: Allen, T. (1977), *Managing the Flow of Technology*. Cambridge, MA: MIT Press.

11 For example, this was shown at a major American technology firm—that "as more time zones are involved [...] the challenges and effort required to achieve success escalate rapidly." Espinosa, A. and Pickering, C., "The Effect of Time Separation on Coordination Processes and Outcomes: A Case Study," *Proceedings of HICSS*, 2006. As noted, time zone differences should be viewed as a continuum elegantly described in O'Leary, M.B. and Cummings, J.N., "The Spatial, Temporal, and Configurational Characteristics of Geographic Dispersion in Teams," *Proceedings of the Academy of Management Conference*, 2002.

12 Extra offshore costs are described in Carmel, E. and Tjia, P., *Offshoring Information Technology: Sourcing and Outsourcing to a Global Workforce*, Cambridge: Cambridge University Press, 2005.

13 Infosys development centers: India (9), China, Australia, Japan, U.K., Canada, U.S. (3), Mauritius.

governance. In contrast to the hundreds of tedious pages of CMM/CMMI,¹⁴ GDM has no official manual. GDM's most important tenet is its division of work among onsite, onshore, and offshore. These three terms reveal the new constructs needed to understand the continuum of distance. Some Infosys personnel are at the client site, others are close by, at *Proximity Based Centers*, and still others are far away at the low-wage location (India) in what is usually called an Offshore Development Center (ODC). This three-way allocation balances the need for proximity (for close coordination) with the need for access to technical capabilities and lower offshore costs.

GDM has also become a powerful part of the marketing message of the Indian providers. The Infosys marketing language in its Web site (2005) states that IT work, using GDM, is "smooth" and "seamless," and that Infosys offers the client an "extended workday." Indeed, customers want to feel assured that there is 24-hour support and that there are always people awake looking over their computers. The GDM has been adapted as a useful term by other Indian providers—and even non-Indian providers—and is found in the literature of some of Infosys' competitors.

THE STORY OF TIME AT INFOSYS

India has only one time zone spanning the entire nation, called India Standard Time (GMT+5½). A majority of Infosys' customers are in the United States, many time zones removed. However, the rest of Infosys' work is with clients closer by, in Europe and east Asia (see Figure 2). All but the U.S. locations have some overlap in normal working hours with India. The work day at the main Infosys campus in Bangalore has flexible hours, but many employees are in their office by 09:00 IST.

In interviews, Infosys engineers gave varied examples of time-zone-induced delays. Significantly, all respondents acknowledged that the cycle of delay, clarification, and more delay, described earlier, is at the root of time zone difference problems.

In spite of being on the other side of the world, there is no *explicit* Infosys focus on overcoming time differences. Interestingly, there is nothing about this topic in Infosys' vast internal knowledge databases, called K-Shop. Rather, the time zone gap is an issue that is deeply embedded in other Infosys areas, processes, techniques, and norms as described below.

Overcoming Time Differences Via Organizational Culture

If Infosys has an elixir for the time zone gap, it is its organizational culture that expects a heightened commitment from employees. This commitment is to work longer hours and work off-hours. In short, it is a culture that expects heroics. Infosys employees—"Infoscions," as they are called—joined an organizational culture that sees the corporation as a global firm covering 24 time zones. The employees accept personal sacrifices to be part of the success of this global corporation. As one module manager, who has been with Infosys for six years, said about working across time zones: "It is in our genes." Another explained it by saying, "When the [young software engineers] choose IT as a career, everyone knows about the need to work over time differences."

There are two types of "actors" at Infosys from whom the company expects heroic behavior: the Onsite Coordinator (OC) and the staff in India. The OC is the liaison, usually an experienced Indian analyst and project manager who is stationed at the client site for an extended period. OCs generally have a designated desk and telephone. The OC's duty is to funnel system knowledge to India, clarify communications, and maintain good customer relations. Since OCs must often communicate verbally with India, there is an understanding that they work many late nights, accommodating frequent phone calls and other interruptions in their "personal time."

India-based engineering staff members are also expected to perform heroics by being time-zone flexible. They work longer hours and sometimes they time-shift. Managers are used to staying late to overlap with U.S. time. For example, one delivery manager said that he works 9-to-9 many days.

The Infosys campuses in India are 24-hour campuses. Many of the 14,000 software engineers in the sprawling Bangalore campus take company buses home. These buses begin at 5:00 PM and continue through 9:30 PM. Many staff stay far later. In India-speak this is called "stay back." The company provides those staying late with amenities: open cafeterias and a well-equipped recreation center.

Other Infoscions go home, but continue working at home, checking e-mail and making international calls. While these tasks were difficult to do just a few years ago, technologies have made them easier.

First, Infosys recently set up laptops with smart card security so that its mid-level and high-level managers

14 In 2002, CMM was replaced by the more robust CMMI. See the SEI site at <http://www.sei.cmu.edu/cmimi/general/general.html>.

Figure 2: Time differences from India and the best time to contact

	Time difference (standard time)	Best time to contact	
		Time in India	Time in distant location
India – Sydney	+5½	Overlap 0900-1230	Overlap 1430-1800
India – Tokyo	+3½	Overlap 0900-1430	Overlap 1230-1800
India – Singapore	+2½	Overlap 0900-1530	Overlap 1130-1800
India – Berlin	-4½	Overlap 1330-1800	Overlap 0900-1330
India – London	-5½	Overlap 1430-1800	Overlap 0900-1230
India – New York	-10½	1930	0900
India – Los Angeles	-13½	0830	1900

could work from home. Broadband connections (DSL) are now widespread and cheap all over Bangalore.

Second, mobile telephones became very inexpensive in India by 2005. Penetration among Infosys software engineers is already close to 100% – so they always seem to be on call. More so than many American and European workers, Indian software employees tend to be comfortable taking calls after hours and on weekends. Additionally, Infosys petitioned the Indian Ministry of Communications to allow workers to place a local call to an international operator in the Infosys Bangalore campus and switch to an international call. This capability allows Infosys to place international calls easily from home without worrying about cost and reimbursement.

Overcoming Time Differences Via Processes

Infosys successfully fused CMM/CMMI with its own GDM to reduce time zone differences. First, with a strong process and strict adherence to CMM/CMMI, Infosys has formalized and fine-tuned much of its development process. Its approach is largely a waterfall, phase-based approach that is stable and low-risk. Phase-based offshoring allows the work to be architected, to remove dependencies as much as possible.

The classic offshore life cycle begins with the requirements phase conducted at the client site with a heavy presence of Infosys personnel. Work is then transitioned offshore where design, coding, and some early testing all take place. Acceptance testing and integration are then conducted, at least in part, at the client location. This approach has by now been routinized at Infosys and other offshore suppliers.

In the interviews conducted for this study, Infosys personnel pointed specifically to two process elements as important to their success in overcoming time differences: formal weekly client meetings and status

reporting. Both of these mechanisms are classic coordination techniques. Both are formally well established in CMM/CMMI. And both are now seen at Infosys as being part of GDM.

The weekly (real-time) meetings usually take place on Fridays. Their significance stems from the respect they command within the organization, their regularity, and the rhythm they provide to collaboration. The meeting agenda revolves around status reports and discussions of issues. Key personnel from both client and provider are present. Those that cannot attend in person attend via audio conference.

Status reports are deeply embedded in Infosys culture. They are derived from the careful documentation mandates of CMM/CMMI. Moreover, the mechanism for status reporting is hard-coded into the Infosys Web-based portal. Reports use standard templates. Each status report is then delivered to the distant client as well as to the Infosys project members in India and around the world.

Overcoming Time Differences Via Technology

Those outside Infosys, observing its success, may surmise that the firm uses unusual, paradigm-breaking technologies to overcome distance and time. In fact, Infosys relies mainly on ubiquitous technologies – mobile telephony, international telephony, and access to the Internet – to mitigate time zone differences. In 2005, Infosys began to distribute IP-based phones at its Bangalore campus. Instant Messaging is often used inside India, across Infosys buildings and campuses, but not across oceans. Similarly, video conferencing is used for executive-level discussions, as well as for training, but not for project coordination. One Infosys software engineer dismissed video conferencing, saying, “We already know the body language [of the others and therefore don’t need video conferencing].”

In fact, due to time differences, the asynchronous technologies are the critical ones. Infosys has methodologies embedded into its two home-grown, integrated tool suites: Influx and Pride. Influx is the methodology suite and Pride is the scheduling and estimation suite. These tools are fundamentally asynchronous tools that allow formal processes to compensate for the additional coordination costs of time zone differences.

Close In Versus Far Away

Infosys derives a majority of its revenues from clients in North America—on the other side of the world. Infosys employees see significant differences in working with these American clients versus those located only a few time zones away (in the Pacific Rim or Europe). In interviews, they stated that coordinating with Europe or Asia is “much easier.” They felt they had “more control over the timeline.” The differences affect two areas: staffing resources and stress.

The size of the time zone difference affects project duration. A 15-year veteran Infosys project manager explained that American projects are both longer in duration and require about 20% more onsite presence, solely because of the time differences (even as he qualified that American firms are generally easier to work with). In his project estimations, he adds 5%-10% for the coordination parameters on American projects over European or East Asian projects.

In relatively nearby Asian locations (Kuala Lumpur and Singapore), Infosys puts fewer staff at client sites (that is, fewer Onsite Coordinators) because the clients feel more secure that Infosys is “an easy phone call away” to get a direct answer to a question.

Infosys personnel also emphasized that the direction of time difference matters, at least to Indian staff. Queries from clients in Australia come at the end of the Australian workday. They require Infosys employees to scramble to get a response before close of business in Australia. On the other hand, queries from London, give Infosys employees the whole afternoon and evening to resolve.

Time Zone Differences Matter, But They Are Hidden

Infosys reports that 99% of its projects are on time and 78% are within a budget variation of 10% from target.¹⁵ In interviews, Infosys employees recognized the difficulties of time zone differences but none

15 Infosys corporate investor slide presentation, internal corporate document, 2004.

could recall any project crises resulting from time differences..

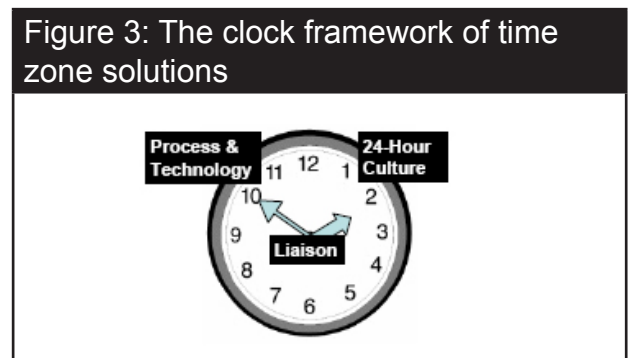
Most of Infosys’ projects are delivered on time in part because of the immense Infosys experience base. This experience has taught project managers to design project schedules that account for delays due to time differences – just as they would account for any identified risk – by building some slack into the timeline. Furthermore, delays due to time differences are usually not perceptible, not by most Infosys project members and certainly not by clients. As one project manager said in an interview, “Delays happen just a few times in a project cycle, so it costs just a few days, it’s not too bad.” Infosys’ projects account for such delays in project forecasts.

THE CLOCK FRAMEWORK OF TIME ZONE SOLUTIONS

This case study shows that Infosys has *not* eliminated coordination costs of time differences, but it is managing to control them and make them predictable.

To organize the practices illustrated in this case study, the clock framework of time zone solutions is introduced in this section (depicted in Figure 3 and detailed in Figure 4). The framework was created by fusing practices from the Infosys case with the time zone practices identified in Espinosa and Carmel.¹⁶ The 10 solutions in the clock framework are divided into three groups: 24-hour culture, liaison (which encompasses process and culture), and process and technology.

Not all of the framework’s 10 solutions are equally important. Nor are they used with equal intensity at global firms. In addition, some of the 10 also address other organizational coordination problems and serve other objectives besides bridging time zones.



16 Op. cit, Espinosa and Carmel, 2004.

Figure 4: Time zone solutions and their practices at Infosys

	Time Zone Solution	Infosys Approach
24-Hour Culture	1. 24-hour awareness. The organization creates a 24-hour culture in which the employee recognizes that he or she is in a global organization and must adjust accordingly. New employees are coached about how to handle time zone differences.	Infosysians share a common core experience of working with clients around the world. Time zone coaching is conducted largely informally.
	2. Time flexibility. Employees do not view time differences as fixed. They adjust and adapt. <ul style="list-style-type: none"> • Employees are expected to be available at all hours. Mobile telephones and home computers facilitate this culture. • Employees work longer hours. • Employees “time shift” by regularly synchronizing their work hours. A variation is distributed paired programming (Distributed Extreme Programming). 	Infosys engineers are always available, accepting calls and messages at nearly any time. They work overtime by staying late at work or, in recent years, working from home. A minority of projects are time shifted, particularly with Europe. However, other time shifting tactics, such as pairing, are rare.
	3. 24-hour work environment. A company that expects its employees to work during off-hours needs to provide transportation, security, comfortable areas to relax, and of course, plenty of food and coffee at all hours.	The Infosys campuses, especially the huge headquarters campus in Bangalore, comfortably supports after-hours working and access.
Liaison	4. Liaison. Usually a middle manager who becomes the human bridge between distant geographic locations. Regardless of time differences, the liaison relies heavily on real-time channels—mostly voice. The most effective liaison is often an expatriate linking the organization back to his home country. As such, he or she is not only a liaison, but an ambassador.	Infosys calls the liaison the Onsite Coordinator (OC). The OC is one of the most important solutions to the time zone gap. The OC is usually an experienced analyst and project manager stationed at the client site for an extended period.
Process & Technologies	5. Allocation. Resources and tasks are carefully allocated by phase and by geography to minimize task dependencies, handovers, and clarification requests. ¹⁷	Phase-based offshoring using GDM reduces dependencies. The classic offshore life cycle begins with the requirements phase conducted at the client site with a heavy presence of onsite Infosys personnel. Most work is then transitioned offshore.
	6. Status reporting. These are routine project reports that help reduce coordination mistakes, which tend to be more costly across time zones. Reports are written to an open central repository.	Status reports are deeply embedded in Infosys’ processes; derived from the documentation mandates of CMM/CMMI. Furthermore, the mechanism for status reporting is hard-coded, in templates, into the Infosys project portal.
	7. Meetings. This mechanism is a routine, periodic, real-time meeting with participants from all locations. Its reliability creates both a coordination rhythm and an efficient coordination clearinghouse.	Infosys holds a routine Friday meeting with personnel from both client and provider. The meeting has great respect within the company and gives employees an emotional reassurance that problems will be resolved.
	8. Escalation protocols. These are guidelines for taking action on problems and questions. Clear protocols minimize the likelihood of a message bouncing around the world in search of the right person. Other aspects: <ul style="list-style-type: none"> • Technology choice: whether to use e-mail, a call to the office, or a call to the mobile device. • Knowing when to “break the e-mail chain” by stopping the back-and-forth of e-mail messages and using the immediacy of the telephone to resolve a problem. 	These protocols take one of two approaches. In some infrastructure projects, the protocols are part of the SLA (Service Level Agreement) contract. In other engagements, such as application development, escalation is done less formally by funneling messages through the liaison – the OC. The junior engineers in India are coached to try to address all issues in India first before they are escalated to the client location.
	9. Methodology-embedded technology suites. These tools structure data that would otherwise be scattered and difficult to query. Integrated suites can be products (e.g., Rational) or home-grown.	Methodologies are embedded into Infosys’ two home-grown, integrated tool suites: Influx (methodology) and Pride (scheduling and estimation).
	10. Awareness technologies. These technologies permit awareness of someone’s availability, their current work, their location, etc. They can include individual calendars, current time zone calendars, holiday schedules, or even desktop video cameras.	Real-time tools, such as instant messaging, are rarely used to bridge time zones, partially because Infosys engineers are coached to escalate problems and questions to module leaders, project managers, and OCs. Project portals incorporate data on time, calendar, and holiday schedules; everyone is aware of, and uses, timeanddate.com.

¹⁷ Grinter, R. E., Herbsleb, J. D., & Perry, D. E., “The Geography of Coordination: Dealing with Distance in R&D Work,” *Proceedings of International ACM SIGGROUP Conference on Supporting Group Work*, Phoenix, Arizona: ACM Press, 306-315, 1999. Carmel, E.,

Global Software Teams: Collaborating Across Borders and Time Zones, Oak Hill, NJ: Prentice Hall-PTR, 1999.

Figure 4 summarizes the Infosys environment. Infosys uses all 10 solutions of the clock framework to mitigate time zone coordination problems, demonstrating a balance between the two sides of the clock framework – process and culture.

The group of process mechanisms come from CMM/CMMI as well as GDM. The cultural mechanisms include working long hours and working during off-hours. The two represent a balance between formal and informal working. Infosys is both very formal (as exemplified by its CMM Level 5 certification) while, at the same time, drawing on informal aspects in its culture. It is unlikely that Infosys could have been as successful at overcoming time zone gaps by simply implementing process and technology solutions without also institutionalizing the role of the OC and creating a culture that expects heroics from its employees.

IMPLICATIONS OF TIME ZONE DIFFERENCES

Time zone differences have implications for CIOs in North America and for individual life styles. It's also worth asking the question, "Can Infosys' model be cloned?"

Implications for CIOs in North America

As CIOs of North American companies manage more offshore activities, they must understand the implications of time zone differences. They must recognize that the time gap introduces non-trivial coordination costs. Firms, such as Infosys, have reduced and stabilized these coordination costs by making significant investments in organizational capital. European CIOs are somewhat less affected by the coordination costs of time zones (see Figure 2).

CIOs have a choice in managing expensive time zone costs. They can create the organizational resources in-house or outsource much of this task to companies like Infosys that have learned to put the pieces in place. In an interview for this study, one Infosys manager noted that his North American clients, who have worked much of their life on co-located projects, are less experienced at coordinating across time zones. In contrast, Infosys employees have never known any other way of working. The role of the Infosys OC, in part, compensates for clients' lack of experience in bridging time zones.

Alternatively, North American IT organizations can invest in building internal resources and experience to

manage across time zones.¹⁸ But to do so, they need to realize that being successful across time zones requires a culture that expects heroics. Firms that cannot build such a culture will probably have missed deadlines and more failures.

Some large western technology firms, such as Motorola, Intel, and Nokia, have successfully built elements of the clock framework in-house. But the global networks of collaborating labs and centers in these firms are somewhat different from Infosys because they work across many time zones using a grid or network structure.¹⁹ Infosys is largely dyadic, linking, say, a client in Arizona with its site in Bangalore.

Implications for Individual Life Styles

This study provides evidence that one critical reason for Infosys' success is its culture, where employees work long hours, work at off-hours, and make some life style sacrifices. Such a culture is not novel in global business. Many global firms have bridged time zones by asking their people to stay up late – be they American, Japanese, or Israeli. When this culture migrated to Indian IT organizations, such as Infosys, it diffused broadly within the organization. Only 20 years ago, relatively few employees stayed up late to work in business networks that had highly connected tasks across time zones. Today, many more are doing so because technology enables global work.

India has been portrayed as a nation that loves the night shift. This myth evolved recently as a result of the call center industry that must adjust its work time to that of North America or Europe. Indians do not like to work the late shift. They feel the personal wear and tear just as their foreign counterparts do. They make personal lifestyle sacrifices to meet other objectives, such as money, prestige, or ambition.²⁰

Infosys' OCs around the world have preferences for working in certain time zones because of their experiences spending countless hours on the telephone with India. One Infosys OC said:

18 One of Infosys' customers duplicated the OC by stationing a client employee on site at the Infosys campus, even giving him the special title of the "externalization prime."

19 Op. cit, Espinosa and Pickering, 2006.

20 Grinter, R. E., Herbsleb, J. D., & Perry, D. E., "The Geography of Coordination: Dealing with Distance in R&D Work," *Proceedings of International ACM SIGGROUP Conference on Supporting Group Work*, Phoenix, Arizona: ACM Press, 306-315, 1999. Carmel, E., "Global Software Teams: Collaborating Across Borders and Time Zones", Oak Hill, NJ: Prentice Hall-PTR, 1999.

“The worst is [the U.S.] west coast. It sucks the life out of you. It is very difficult. It taxes your personal life [...] When is dinner time? I had 200 people [to deal with]. It really taxes you.”

On the other hand, he believes the best place to be as an Infosys OC is Europe. “In Europe – evenings are yours,” he said. East Asia, too, is problematic because most Infosys employees in India do not get to work early: “[When I was in Kuala Lumpur, Malaysia, I] was ahead of them and had to put in late hours.”

Can the Infosys Model Be Cloned?

A key competitive question is whether the Infosys model can be cloned. The company has three unique resources for handling time zone differences: the GDM, its culture, and its OCs. As described earlier, GDM is a loose model of task allocation, organizational structure, and governance. GDM can be replicated in other professional organizations. In fact, a number of competitors, including non-Indian global sourcing firms, claim to be using GDM.

Its culture, though, is more difficult to replicate. Few organizations can expect their employees to consistently work long hours and work during off-hours. Yet Infosys has been able to achieve this commitment by nurturing a highly regarded culture. The firm is known for institutionalizing mentoring, for pushing decision making to lower ranks, and for making other efforts that make it one of the best places to work in India. At the same time, Infosys is highly selective, accepting less than 1% of applicants. In return for being hired, employees know they are expected to contribute more than just their talent.

Infosys’ third unique resource is its OCs. Some elements of this liaison position are also somewhat difficult to replicate in competing foreign firms, such as IBM and Accenture. While any OC can be compensated enough to stay up late at night to call India, Infosys OCs have two advantages. One, they grew up in the Infosys organizational culture. And two, they are Indian. Being from the same culture allows the Infosys OCs to better communicate with staff back home than a non-Indian American or European.

One final item is worth contemplating: whether the entire model is sustainable in the longer run – even at Infosys. Infosys has the aura in India that Microsoft once had in the U.S. In the 1980s and 1990s, “Microsofties” (the fond label for Microsoft engineers) were notorious for working late and sleeping in their offices. This aura dissipated as the entrepreneurial,

pioneering spirit waned at Microsoft. Rapid growth at any firm can dilute its culture. Infosys is growing much faster than Microsoft ever did. So while Infosys will try to preserve its cultural resources, it will also continue to do what it already does well, which is to continue substituting formal processes for informal ones. By doing so, it may indeed succeed in delivering across the time gap over the long run.

ADVANTAGES OF TIME ZONE DIFFERENCES

The new era of global IT work offers two new and unique advantages: low costs due to wage differentials and *follow-the-sun*.²¹ The focus in this article is on the latter (which is also known as *round-the-clock* work).

Follow-the-sun, as the term implies, exploits time zone differences to get project work done faster by working on it continuously. For example, a team in North America can hand off its work at the end of its workday to collaborating team members in India or China, who can then continue the tasks while the Americans sleep. Managers have been enamored with follow-the-sun. If software work can be coordinated properly, then project duration can be reduced by a factor of two. Moreover, if three teams are correctly positioned around the globe, then a theoretical threefold reduction is possible! This is much like a factory running three shifts, 24 hours per day, producing three times the volume.

Follow-the-sun at Infosys

Many Indians (among them, young Infosysians) believe that India has advantages precisely because it is half a world away from its clients, because this separation can enable follow-the-sun. Yet, Infosys—and most Indian IT firms—actually do relatively little follow-the-sun work to compress project times. They only have limited spurts of follow-the-sun. Sometimes there are one-day episodes; at other times, it happens over several days in a multi-month project. Infosys employees noted in interviews that their follow-the-sun spurts are quite limited and highly dependent on task and life cycle phase.

Two interesting follow-the-sun examples did emerge in the interviews. Both are somewhat different from the follow-the-sun archetype, though. The first took place in an unusually critical project; the second

²¹ Early mentions of follow-the-sun in software appeared in two sources: Essick, K. “IBM launches Around-the-Clock Java/VisualAge Development”, *Computerworld*, February 19, 1997, and Op. cit., Carmel, 1999.

involved use of computer resources, rather than human resources. Each is described briefly below.

The first follow-the-sun situation took place at a giant American corporate client that had just gone through a major merger. The American CIO gave the Infosys project team only two months to merge two large corporate systems that managers estimated would take six months to merge. Importantly, “cost was no object.”

“There was no time for training. There was no time [...] so we chose the best people [...], the best experts, [...we] put them into a room together [...]. We pulled the best programmers off of other [client] projects to get this done.”

(Project manager at Infosys).

The onshore and offshore sites were able to coordinate their tasks closely as a result of the special circumstances. One site reviewed the code after the other site coded. Thus, the offshore and onshore teams were able to pass work to each other daily, and compress project duration.

The second follow-the-sun situation did not involve collapsing project duration, but rather sharing resources and saving money on investments in expensive development and testing environments. A large-scale wireless project with 160 people required an infrastructure and testing environment estimated to cost \$3 million. The client did not want to replicate this environment offshore in India. Instead, the environment was used during the American daytime by the client and accessed from offshore during the American nighttime. Thus, the assets were better utilized over two shifts.

Why Follow-the-sun Is Less Relevant to Infosys

As the above example of the giant merger illustrates, once speed, or rapid iteration, is required, Infosys chose more co-location rather than time separation. Infosys’ successful work style is phase-based and not amenable to acceleration. In general, the company’s limited use of follow-the-sun should not be surprising, for several reasons.

For one thing, to truly reduce project time, daily coordination for follow-the-sun must be *flawless*. One miscommunication in a hand-off and an entire day’s worth of work can be delayed. In practice, few globally dispersed efforts have been able to fully capitalize on the theoretical advantages of follow-the-

sun because daily coordination is simply too difficult for most software development teams. For example, one pioneering, high-visibility IBM team was set up to capitalize on follow-the-sun.²² However, fairly early, the global team discovered that daily hand-offs were too difficult to coordinate.

Infosys also does not use follow-the-sun because of the types of tasks it performs. It is not an independent software vendor (ISV, also known as software product firm). ISVs are driven by the pressures of technology innovation cycles to shorten their time-to-market. Start-ups in Silicon Valley have been excited about rapid prototyping of new software products by handing off the coding to India, and then getting it back for comments and refinement on a daily basis.²³ ISV projects are better suited to follow-the-sun because they tend to be smaller and involve fewer people and fewer organizational dilemmas. They also utilize the 10 solutions of the clock framework differently than Infosys does. For example, awareness technologies, which are not intensely used at Infosys, tend to be used more extensively at successful global ISVs.

Generally, at Infosys, time-to-market goals are not as acute as other objectives. Small delays, such as those caused by miscommunications and clarifications, do not affect the business of Infosys or its clients. It is not simultaneously possible to reduce timeline by half, perform at CMM Level 5, and also take advantage of all the low-cost benefits of offshoring. At the same time, Infosys engineers work extra hours anyway, so there is some duration reduction as a result – even without follow-the-sun.

Also, Infosys is involved in many types of activities. For some of these, time-to-market or time-to-response are more critical than others. For example, for production support, time is critical because a major corporation’s main information system may be awaiting a fix. Testing or technical support are better suited to follow-the-sun because they are usually small tasks (highly granular), of low complexity, and can be handled routinely between the time-separated sites. Thus, follow-the-sun can be effective for some activities and for certain phases in IT work.

CONCLUSION

Time zone differences simultaneously offer costs and opportunities. The time zone gap is an obstacle when it causes delays, thus adding coordination costs. It

²² Op. cit, Carmel, 1999.

²³ Boudreau, J., “Valley Start-ups’ Cubicles Thousands of Miles Apart,” *SiliconValley.com*, December 19, 2005. Accessed Dec 20, 2005.

can be an opportunity when it can be used to shorten time-to-completion, reducing some costs and leading to other competitive business gains. As technology has thrust companies into tighter global networks, companies are compelled to think about time zones in new ways.

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APPENDIX: METHODOLOGY

The author collected most interview data on site on the Infosys Bangalore campus with full access to personnel. Additional interviews were conducted by telephone. In total, 14 interviews were conducted with Infosys and client personnel. Most Infosys personnel interviewed were mid-level managers, such as project managers. As is typical at Infosys, all personnel interviewed had direct personal experience working across time zones. Most of the interviews were conducted using an 18-item, semi-structured interview instrument that focused on issues of coordination and time zone differences. In addition, the author was given extensive guided access to the Infosys intranet and knowledge management system. This allowed access to firm documents, systems, and portals. Data were collected in 2005. Data analysis used qualitative methods. Transcripts were analyzed first for factual answers to questions. During this analysis, data were analyzed to search for recurring themes and the main time zone solutions were discovered. In the second round of analysis, the patterns were validated and the relationships between the variables were confirmed. The data were then organized into the solution framework, augmenting the framework presented in Espinosa and Carmel (2004).