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Global circuits of gender: women and high-tech work in India and the United States

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This article addresses the experiences of women in engineering and technology careers in an increasingly transnational era. It draws from an interview study, conducted during the early stages of the global high-tech industry, with over 180 women and men IT personnel in three organizational settings: a major Silicon Valley computer firm, its multinational subsidiary in India, and a local Indian IT firm. The IT industry, I find, has created new avenues of employment for women transnationally, but with variable trade-offs. Surprisingly, the masculine “cultures of engineering” often noted in the US literature are *weaker* in the Indian cases. These women face less questioning of their technical competence and gain greater access to jobs such as engineering. In the US case, however, women workers are more likely to become IT managers and receive comparable wages to their male colleagues. I situate these findings in the contextual politics of information technology in Indian and US societies, and their contradictory effects in both drawing women into the IT workforce and excluding them from organizational power. Furthermore, I use the multinational case to explore what happens in the global circuits between these sites, and if they undermine or exacerbate various hostile environments for women.

Key words: gender, high-tech firms, work, India, globalization

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Introduction: women in engineering and IT

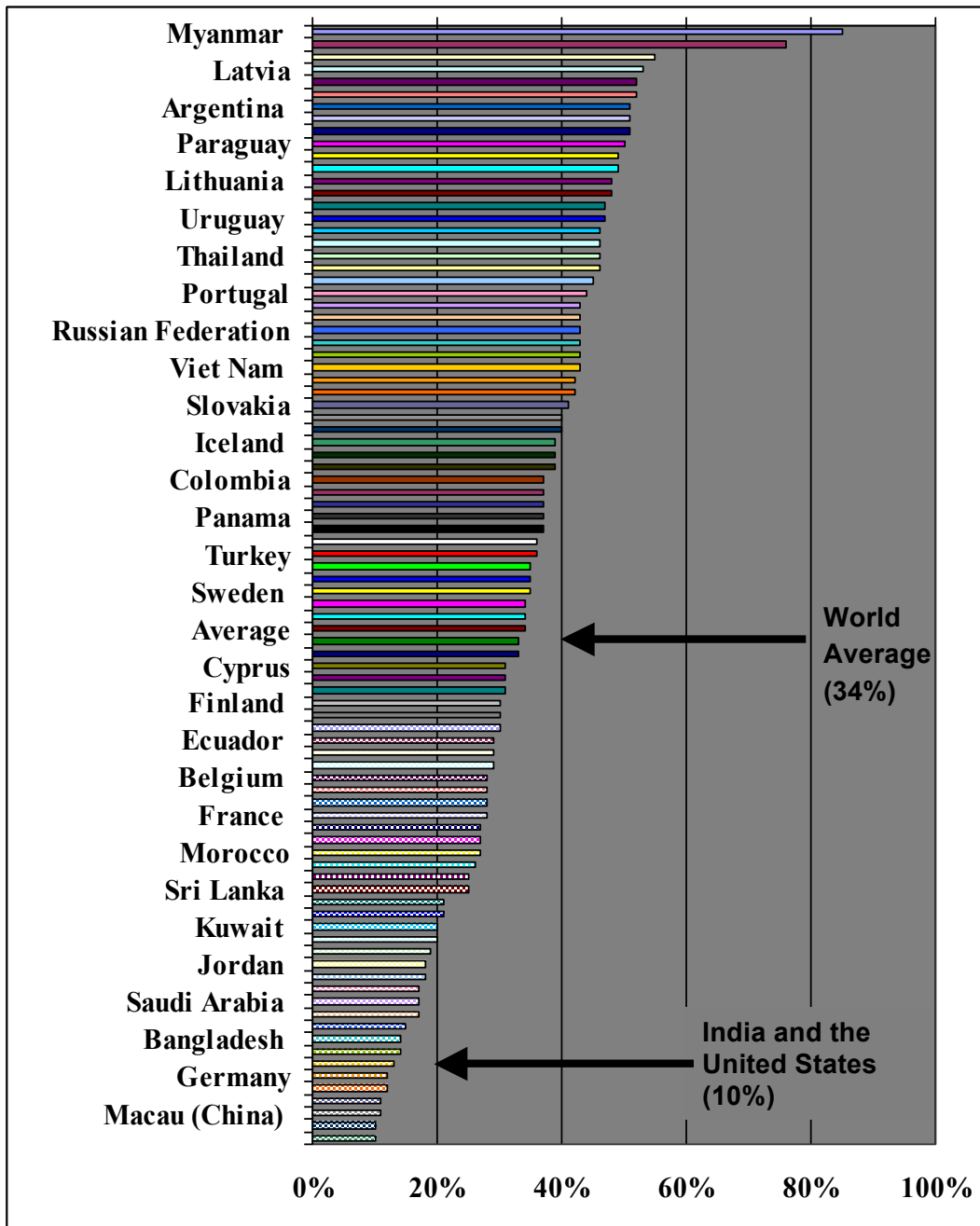
The literature tells us that IT workplaces can become hostile or even toxic environments for women (Frehill et al. 2007). Not only are they more male-dominated than other types of firms but they also tend to be governed by “cultures of engineering” in which male technical prowess is an organizing principle for social relations (Burris 1993; Hacker 1981; McIlwee and Robinson 1992; Wajcman 1991; Wajcman 2004). The following project seeks to expand on this important theoretical field to address the implications of these cultures of engineering in an increasingly global era. Little attention has been directed, first of all, to the issue of whether there might be different kinds of discriminating environments across national contexts. Common types of discrimination experienced by women engineers in the Global North may be less prevalent in other parts of the world. Moreover, there may be hidden advantages for women engineers in Global South settings, which are useful in alleviating tensions in the Global North, and vice versa. Second, there has been surprisingly little research attention given to the global dynamics of IT workplaces, even though the high tech industry is in a stage of rapid change. In this article, I’ll present the notion of *global circuits* as a focal point for viewing these processes (Ong 1999; Peterson 2003; Sassen 1998; Sassen 2000). I argue that global circuits have the potential to undo, as well as exacerbate, some of the problems that women have been facing in IT.

Diverging trends in India and the United States

The cases of India and the United States illustrate many of the global dilemmas of women in technical work (Hafkin and Huyer 2006). What they represent, first of all, is the difficulty for women in gaining access to technical jobs. Even though these countries vary so much in terms of size, population, wealth, and so on, both have low proportions of women in these jobs.

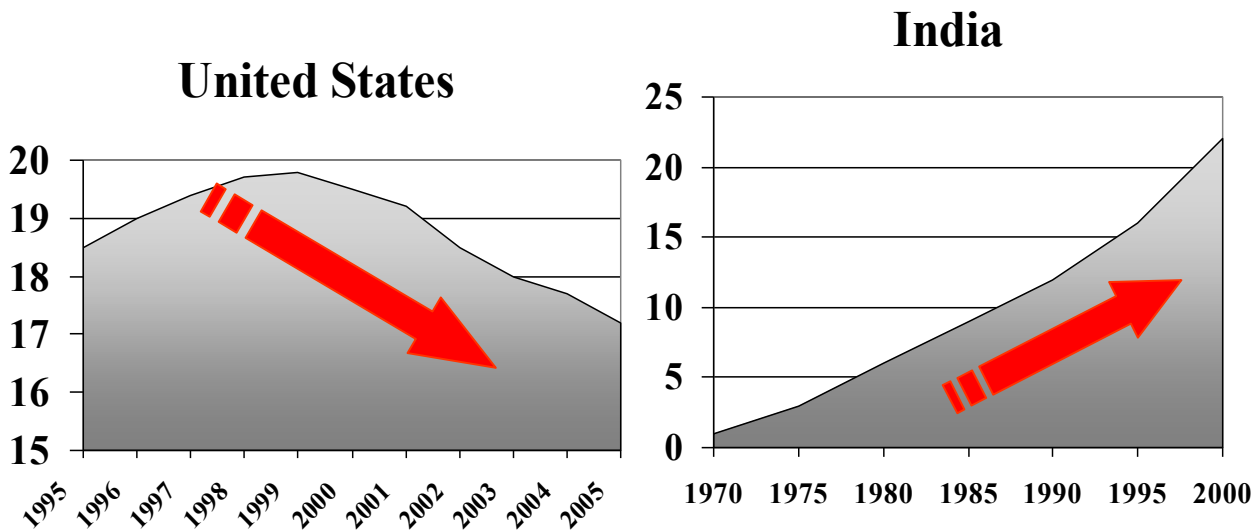
Interestingly, features of the United States such as greater wealth and lower population *do not* help pull women into technical work. Looking at the percentages of women in scientific and technical research around the world (Figure 1), we see that both India and the United States are at the very bottom of the scale (UNESCO Institute for Statistics 2006). While the world average (of about 90 countries) is 34%, these two countries average no better than 10%. They diverge, however, in their long-term trends and in the direction of women’s access to technical work. The United States is on a clear downward trend, while India is moving upward. Enrolments in engineering degree programs have declined in the United States to about 17% in 2005, while they have been on a steady increase in India, rising to 22% in 2000 (Committee of the Indian National Science Academy 2004; National Science Foundation 2007).

Figure 1
Percent Women in Scientific and Technical Research Globally, 2003



Source: UNESCO Institute for Statistics 2006. Selected country labels only.
 Data for the United States is from Babco and Ellis 2004.

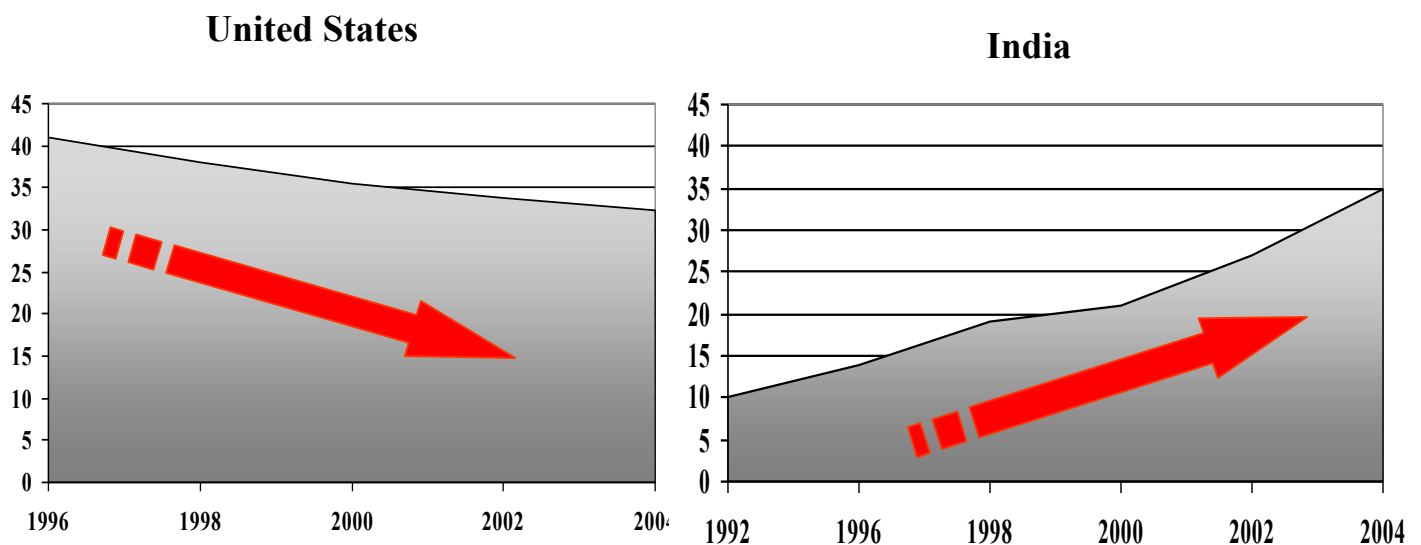
Figures 2 and 3: Percent Women enrolled in College Engineering Programs



Sources: National Science Foundation 2007; Committee of the Indian National Science Academy 2004. Values for selected dates are estimated by the author based on broader trends.

The same is true with IT jobs. Figures 4 and 5 present trends in the percentage of women in the overall technical workforce (including high-skilled jobs such as technical and scientific research, as well as lower-level jobs in data entry, communications, etc.). From the early 1990s to the mid-2000s, the United States faced a *decline* in women’s access to IT jobs, dropping from 41% to 32%, whereas India experienced a sharp incline from 10% to 35% (Information Technology Association of America 2005; NASSCOM 2006). In fact, in 2004, India surpassed the United States in women’s IT workforce participation at 35%, which was 3% over the United States’ figure.

Figures 4 and 5: Percent Women in the Information Technology Workforce



Sources: Information Technology Association of America 2005; NASSCOM 2006.

The overall numbers of women in IT jobs may be tipping towards India as well. Statistics show that India is producing more engineers than the United States—with some estimates as much as 300,000 in India, versus 100,000 in the United States. Indeed, industry experts at the American Society of Engineering Education observed that there were more women engineers employed in India by 2007 than in the United States (National Network of Education 2007). There are many theories and explanations of why women in India might have a better edge in high-tech work and research. Childhood socialization plays a part (Cohoon and Aspray 2006; Fletcher 1999). Scholarly studies have found that Indian pre-college students are much more confident about science and engineering and supportive of women in these fields than in the United States (Mukhopadhyay 2005). A study in four Indian cities found that girls are far less fearful of science and engineering subjects, that students (of either gender) do not generally view science and engineering as “unfeminine,” and that girls even express positive attitudes about these subjects. Their families, moreover, support girls’ entry into science and engineering for its earning potential, prestige for the family, and improved marriageability. Other explanations for varying levels of women’s presence in IT careers look at the workplace itself, and how organizational dynamics create barriers for women technical workers and researchers (Hacker 1981; McIlwee and Robinson 1992; Scott-Dixon 2004; Woodfield 2000). This latter approach is the one I take, as I’m interested in the barriers that are embedded in organizational practices—written and unwritten, formalized and informal—in policy and in everyday practice.

Research questions and methodology

Two research questions guide this analysis. First: Can we benefit from looking in “unlikely” places for alternative models of women’s advancement in IT careers, especially through comparative methodologies? My curiosity, however, is if there might be *different kinds* of discriminating environments across national contexts. Moreover, might there be hidden advantages in these settings, that are harder to see when only looking at single firm or national contexts, but more visible when contrasting them side by side? Finally, might we be able to use those hidden advantages to our benefit? What I find is that the IT industry has created new avenues of employment for women transnationally, but with variable trade-offs for women’s high-tech careers. Surprisingly, the masculine “cultures of engineering” often noted in the US literature are *weaker* in my Indian cases. These women face less questioning of their technical competence and gain greater access to jobs such as engineering. In the US case, however, women workers are freed from the boundaries of spatial mobility in their technical work that are common in the Indian firms. These women are also more likely to become IT managers and receive comparable wages to their male colleagues. I situate these dynamics in the contextual politics of information technology in Indian and US societies, and their contradictory effects in both drawing women into the IT workforce and excluding them from organizational power.

My second research question is: How will globalization affect this process? Will it undermine or exacerbate the discriminating environments faced by women in engineering and technology careers? I explore this by focusing on a US multinational firm located in New Delhi. Rather than exclusively adopting gendered patterns of either the US or Indian firms, TransCo managers hybridize the two forms, which makes gender discrimination more complex. Still, this also creates unique opportunities for women engineers and technical workers, as managers and employees destabilize the

discriminatory IT environments of local contexts and propose alternative work relations.

This analysis is based on case studies of three computer companies that share size, industry, and market characteristics, but have different locations and positions in the global economy. The first is AmCo,¹ a US company located in Silicon Valley, California. It was a founding company of the high-tech industry in Silicon Valley, and had subsidiaries all around the world. The second company, TransCo, is one of these subsidiaries, situated in New Delhi with its factory in Bangalore. Thus, it had US ownership, management, and policies, but was staffed mostly by Indians (with a few US expatriates). The third company, IndCo, is the Indian counterpart to AmCo. It was owned by Indians, and located in New Delhi. Like AmCo, it was a leading high-tech company in its country (at the time of the study), and had subsidiaries worldwide, including California. All three companies had operations involving software development and hardware production, and similar gender ratios in their workforces—roughly 25–30% female.

Data collection occurred between 1995 and 1996, a time when the IT industry was taking off in profound ways in both India and the United States. This was also a period when women were being recruited in these industries in substantial numbers for the first time. My methodology involved original field work at each location. This included observation of work relations, document analysis of company human resource materials, and in-depth interviews with workers and managers. At each company, I did field work at two units—the corporate office and a factory. Interviews were conducted either in English or in Hindi with the assistance of an interpreter, and lasted 30 to 90 minutes. The total number of interviews at each site was 34 at AmCo, 60 at TransCo, and 51 at IndCo, with roughly half the interviews at the corporate office, and half at the factory in each company. Each sample was randomly selected, and balanced according to gender and occupational level.

As my interest was in exploring the organization-wide dynamics that affect women in high-tech firms, the examination crossed many departments, from top to bottom: management, marketing, engineering, accounting, and so on at the corporate level, to circuit board manufacturing and computer assembly at the production level. The majority of the workers in all locations were 30–40 years old, married, and had one or two children. In addition, the samples reveal relatively high educational levels. Even at the factory, most workers held a high school diploma (at the lowest, 75%), and many of those held a post-high school degree as well (37–50%). In the analysis below, I will highlight the experiences of women doing work that is directly technical. However, I will attempt to show that the broader dynamics of high-tech firms affect many employees, even if their work is not technical.

In the following section, I sketch profiles of the three firms and their attitudinal climates towards technical women. I start with a comparison of AmCo and IndCo. These are similar IT firms, which curiously exhibit very different types of discriminatory environments and different types of hidden assets for women in IT.

AmCo: skill discrimination in IT work

Women technical workers at AmCo describe a type of discriminatory environment that parallels studies of IT workplaces in the United States and Western Europe. Much like

the “culture of engineering,” AmCo’s gender hierarchies are organized around the core issue of technical skill. Employees and managers see technical competence as a masculine trait. In turn, they treat women as second-class technical personnel, or even non-technical personnel. This skill-based division becomes the main barrier for women engineers and researchers, both in everyday interactions and in structural rewards.

It becomes problematic for women at AmCo when they display or show themselves to be technically skilled in their daily routines. They report a number of disciplines from male colleagues and supervisors that enforce this. Sometimes colleagues will enhance their own status and deflate women’s status along expert/non expert lines (Burris 1993). They may overemphasize the technical aspects of men’s jobs and trivialize those of women’s jobs. They may denigrate women’s engineering skills. Randal, a quality checker in the factory, explains how women engineers are weaker in intellectual ability because they are driven by emotion rather than logic:

The men are more capable of doing the engineering job, because engineering work is harder and it is more complicated. Men have the capability to make better decisions—not emotional ones. In engineering, you cannot go by emotion. It should be more by logic. Women make more emotional decisions, and that does affect the work.

Colleagues may also sporadically test women on their technical competence—questioning whether women really understand the minutia of their engineering jobs. This enforces an expectation of incompetence and sends women into self-doubt. Managers may also “disappear” women’s work: ignoring women during technical meetings, or the final products of their technical work (Fletcher 1999). In more extreme cases, women engineers at AmCo report how superiors mock them publicly over their technical knowledge as a form of humiliation.

There are trade-offs for this system of gendered technical work at AmCo, however (especially compared to its Indian counterpart, IndCo). One is that there are more women in management. While women are less respected for their technical skills, they are given more freedom to display skills in leadership. In fact, many of my informants were promoted out of their engineering jobs to become IT managers. AmCo has had many women CEOs over its history, a rarity among Fortune 500 firms (Catalyst 2003).

One employee explains: “It is true that the proportion of women in the management cadre is much higher than the proportion of women in engineering. As you move up the manager levels—say at the project manager level—the ratio is 30:70, where 30% is female managers.” By 2000, women at AmCo were 43% of mid-level managers, 33% of senior managers, and 25% of the executive council members. This pattern is especially notable in relation to the other firms of my study. AmCo has 40% women managers, whereas IndCo has 31% and TransCo has only 27%.

Another hidden asset is that AmCo women are much more likely to receive comparable wages to their male colleagues. While all the firms of my study exhibit a gender gap in wages, it is smallest at AmCo. The difference between women’s and men’s wages is only 14%, compared to 44% at IndCo. As I’ll discuss further, gender equity policies contribute to these gains for women at AmCo, which are more common in the US institutional and organizational context than in India (Poster 2008).

IndCo: spatial discrimination in IT work

Women IT workers at IndCo describe a very different kind of discriminatory environment. Gender inequity is not based on women's *skills* as technical workers, but on the *spaces* where they do their technical work. This model of male privilege in high-tech work has little to do with denigrating or questioning women's mental capabilities to do engineering or other technical work. Instead, it focuses on limiting where, when, and with whom women's work is done.

The dynamic of space has been a well-noted tool of power and male authority in high-tech workplaces. For instance, the high-tech industry in many parts of the world has achieved its dominance through regional geographic networks of research, business, and entrepreneurial IT actors (Saxenian 1994). This industry has also thrived through the spatial formation of "high-tech parks," where scientific and technical researchers separate themselves from the rest of the world and intensify hyper-masculine work cultures (Massey 1996; Massey et al. 1992).

In the case of IndCo, we see another kind of use of space. It involves dividing physical spaces inside the firm as a way to manage the entry of women into high-tech work, and to maintain male control of resources inside the firm. The pretence is that of protecting women from dangerous environments, and limiting their movements to technical spaces that are nonthreatening. This is problematic for women, as co-workers and managers at IndCo place "boundaries" (Lamont and Molnar 2002) on women's interactions and movements in the high-tech environment, both within and outside the firm.

These boundaries restrict women's daily routines and their abilities to do technical work in several ways. Some of the boundaries are *temporal*, meaning that women are not allowed to work at night, or after regular business hours. Of course, some women don't mind this practice. However, it becomes problematic when they are left out of crucial research meetings that are held with the rest of the engineering teams. Other boundaries are about women's *movements*, as they demarcate "male" spaces in the firm (be it offices, floors, rooms, etc.) and informally discourage women from entering. This becomes problematic when women need to discuss technical work with male colleagues inside such offices. Restrictions on mobility outside the firm prevent women from making contacts with other engineers and researchers in universities. They also inhibit women from travelling outside the city and country to participate in global technical workshops—events that their male colleagues attend and which are increasingly important for high-tech work.

Yet behind these barriers, there are hidden benefits for women at IndCo. As noted previously, the masculine "cultures of engineering" often cited in the US literature are *weaker* in my Indian cases. Managers and colleagues are much more likely to respect women's technical skills than at AmCo. Throughout my interviews with IndCo employees, I found a pervasive conviction that women and men have similar mental abilities to do technical work. Women at IndCo face less doubting and testing of their technical competence. At the corporate office, a staff member says: "A woman is equally competent. What men can do women can also do, workwise. What men can do, women can also do workwise. I don't think there should be any discrepancy."

Furthermore, while many jobs are sex-typed at IndCo, engineering is not one of them: “For some of the jobs, you need different people. A lady may be good, and a man may not, but not for all jobs. Like with an electronics engineer, it’s fine—both [women and men] can work.” A factory operator also articulates this idea: “There are places where ladies should be—like in technical work . . . In the interest of the company, the woman should work here.” Other studies of gender in Indian high-tech firms have found similar patterns (Chhachhi and Pittin 1996; Parikh and Sukhatame 2002).

This paradigm reflects not only a greater respect for women’s abilities but also reveals an assumption that *technical work itself has no gender*. This orientation towards women technical workers alters the climate of IT work in India. It facilitates women’s entry and acceptance into highly technical jobs to a much greater degree than in the United States. This marks another hidden asset for women at IndCo: greater access to jobs like engineering. A woman engineer explains: “Actually in IndCo, you will find quite a few females. The whole department must have around 40%. In our group, most of the people are women—five out of eight. We are the communications group, the one that works on the communications software.” Engineering has larger concentrations of women than many other departments at IndCo, and, moreover, far greater concentrations of women than at AmCo, where women occupy at best 15% of the engineering jobs. Despite the celebrated location of this firm in the global high-tech landscape, AmCo has the lowest proportions of women in its jobs that are most closely related to technology.

TransCo: global circuits and the hybrid model of gender in IT work

The second research question of this analysis is about how globalization will affect this process: Will it undermine or exacerbate the discriminating environments faced by women in engineering and technology careers? For this, we turn to the third firm in the study, TransCo, which is owned by AmCo but located in New Delhi. It has US policies, but completely Indian staff. The question is what happens when firms like this cross national borders? Should TransCo look more like AmCo or IndCo, or something else?

TransCo defied my expectations about what multinational firms typically do—it did not singularly impose or adopt either model of IT work, but instead hybridized them together. The medium for this process at TransCo is what I call global circuits. This term refers to organizations and their components that cross national borders, whether physically or virtually. It can refer to a whole firm, as in the case of TransCo, as a multinational subsidiary. Or, it can refer to elements within these firms, such as their employee policies, their managerial staff, their technical personnel, and even their teams and work tasks—anything that can be transnationally mobile.

The key to understanding global circuits, however, is how they are freed from many of the traditional constraints of local IT settings, whether that is an everyday habit or long-standing point of view of managers about how to treat women in high-tech work, or whether it is a set of formal governance systems which dictate employee practices for managers (for example, from a corporate head office, from the state, etc.). Actors in global circuits, quite significantly, are in a liminal position where they are less bound by such ties—for both good and bad reasons.

Indeed, this hybridization process at TransCo has the potential for transforming previous types of discriminating environments for women in IT, and creating more

egalitarian technical workplaces. However, it can also make new problems for women engineers and technical workers. Next, the discussion presents some examples of these global circuits, in transforming both the written policies and informal climates of women in technical work.

Innovations in policy: merging the best of India and the United States for women in IT

There are many positive outcomes of the global circuits for TransCo's employee policies. Consider what happens with work-family balance. Common by-products of the informal "engineering culture" are its "late night meetings [and] extended travel as the norm" which "put disproportional social pressure on women, especially mothers and single parents" (Catalyst 2003:11). On top of this, formal policies can put additional pressure on women (Kelkar et al. 2002, 2005; Poster 2005a; Poster and Prasad 2005). One study of women in 75 IT firms found that the main complaints were about inflexible demands regarding working hours, insufficient support for flexible schedules and personal responsibilities, and incompatible career-building and family-building cycles (Catalyst 2003).

IT firms in both the United States and India were addressing these strains with very creative strategies at the time of the study, yet on two separate tracks. TransCo, in an extraordinary step, combined the best of the two. Furthermore, it customized these policies for the needs of its own workforce. Managers did this by taking advantage of the firm's transnational position between the United States and India.

From its US parent firm, TransCo adopted flexible scheduling policies that accommodated work to employees' family demands. In fact, TransCo claimed to be the first firm in India to institute "flextime." TransCo managers took this policy further, adjusting it to the particular work-family conflicts of the workers. One major issue, for instance, was power outages. Such events have been common in cities like Mumbai, Delhi, and Bangalore, and leave parts of the city without electricity and/or water for several scheduled days during the week. Accordingly, employees at TransCo were more interested in flexible scheduling across days of the week, rather than sliding hours within a single day. Managers responded with a program of "alternative work options," which combined flextime with other forms of job restructuring.

From local Indian firms, however, TransCo borrowed and integrated another set of policy traditions—material benefits for families. Many Indian firms (like those in Europe, Canada, etc.) offer various kinds of concrete supports for workers' families. They include direct payments, subsidies, and even certain kinds of tangible objects for the household. Therefore, like its Indian counterpart IndCo, TransCo offered maternity benefits of three months paid leave, plus funds for delivery and birthing costs, and paid for transportation to and from work. Furthermore, TransCo managers augmented these material benefits with a package that included over 70 items, including school tuition, kitchen items, and wages for servants to clean and cook in the employees' homes. Managers were also in the process of developing a set of policies unavailable in either of the other two firms, such as coverage of legal and medical expenses for adopting a child.

What resulted from this were unique work-family policies. TransCo's programs were far more extensive and innovative than those of either its parent firm back in the

United States or comparable firms in India. This “hybrid” model arose out of the transnational context. First, managers were in an unusual position to view first-hand the work-family policies from both countries. Second, these managers had the opportunity and authority to generate policies in creative ways. This creativity had a tangible impact on women’s experiences in the firm. While my informants had many criticisms of TransCo, they had few about the work-family benefits. Women workers were overwhelmingly impressed with and appreciative of the level of support for families, and reported that it vastly improved their mental and physical abilities to do IT work.

Innovations in the IT climate: removing informal barriers for women

Another kind of innovation occurred at TransCo through global circuits. TransCo’s global policies—imported largely from AmCo—prevented many elements of the space model in IT from emerging and/or taking hold in the firm—even though the staff was Indian and the firm was located in New Delhi.

In particular, two AmCo policies play a role in discouraging the discriminating environments that appear at IndCo. First is a set of “fairness” programs, focused on gender equity and diversity inclusiveness, which promote equal treatment of workers by gender, ethnicity, religion, and so on. Second are the policies supporting “democratic relations,” which emphasize a participatory, non-autocratic workplace through flowing communication, open floor plans, and a breakdown of status hierarchies.

Together, these policies erase the visible markers of gender inequality that are common in the space model of IT. They make it much harder, in other words, for managers to justify the boundaries of women’s activities. An engineer explains: “Usually in Indian companies, men and women won’t mix all together. They won’t talk more than a ‘hello’ or ‘hi’. They will hesitate to talk. But it is not the case here. They mix well.” A worker in the factory echoes how this climate improves employee cooperation when making computer circuit boards: “For whatever reasons, normally in Indian companies men and women don’t mix. Men and women sit separately, on separate benches, tables. Here, we work together. That happens more in multinational companies.”

Many women at TransCo appreciate what this does for their work routines. A field engineer says: “AmCo policy is our founder’s dream, and many people follow it. It is the most beautiful thing I have ever seen. And the environment is very friendly. It is quite different from other Indian companies. It is quite different from other multinationals. *It has a total freedom.*” Employees describe how they have opportunities in their technical work and research to interact and communicate with each other without many symbolic or physical gender boundaries.

In short, one of the hidden assets of the global circuit is its ability to displace highly entrenched forms of gender relations and assumptions about technical women. These features illustrate an undoing of the discriminatory climate for women in engineering and technical work. The absence of these boundaries makes technical work easier to do, and makes women more empowered. There is an irony to the implications of AmCo policies, however. While they are effective at removing and blocking the space model of gender hierarchies in IT, they remain fairly useless for addressing the skill-based model, as I will show next.

Hazards: implanting new barriers for women, hybridizing IT environments

The downside of the global circuits at TransCo is that new kinds of barriers for women in IT are introduced, implanted, and even combined. This process has a few stages. It starts with AmCo policies, which subdue the space model of IT, but push it to a new domain. Although less apparent in the internal relations of the firm (i.e., when women are interacting and working with colleagues), the space model becomes stronger in external relations. This is the context where TransCo women are interacting with various clients, customers, government officials, or other researchers in the outside environment. In this domain, women continue to experience the boundaries on IT work that they have encountered in similar local firms. Here's an example of how male employees at TransCo retain the space model in women's work outside of the firm:

We have internal office jobs and then external world jobs, and I don't see any barriers to the other sex [women], that they will not be able to do these internal jobs. But with external jobs, from the organizational point of view, if I were the manager, I would prefer a man to handle that job. For example, I have to have somebody to go to the customs house to clear commercial computer goods. If you have to go to the customs area at the airport, and encounter the environment there, I certainly think that a woman would do it within her grit and determination, but would just not be efficient.

Meanwhile, something else happens. Managers, who came from the United States to set up and run the firm, very subtly and unconsciously carry with them the practices of their engineering culture. In turn, TransCo women began to feel the same kinds of barriers that their AmCo counterparts face: the questioning of their engineering skills, trivializing of their technical aptitudes and accomplishments, and an overlooking of their contributions to team software and hardware projects.

This surprised Shilpa, a female senior engineer. She encountered this new paradigm when her male colleagues expected her to do administrative rather than problem-solving work in R&D. Trying to figure out why, she confided in a colleague Tom, who recounts the conversation:

She said, 'Gee, do you think this is because I was not introduced properly into this account, or this environment, or this particular company—or just because I am a woman?' Shilpa has seen it [the engineering culture] from the other [woman's] side, and we have talked about how some male engineers will assume that the women engineers can [only] do things like the documentation, and that kind of stuff—not really getting in there, and figuring it out—created problems. And some of it is because they're women.

Thus, the overall impact of the global circuit is a hybrid model of gendered technical work. It combines elements of both the skill- and space-based systems, applying one to women's work inside the firm and the other to women's work outside the firm. This creates a confusing environment for women to work in, where they are expected to follow and display competing sets of gender rules that depend on the situational context. In this way, global circuits within IT work are highly complex, variable, and layered.

Conclusion

This study has important implications for women doing technical work. It finds that, in response to the initial research questions, both US and Indian settings exhibit discriminatory climates for women with hyper-masculine interpersonal relations and gendered technical environments. While the focal point of that discrimination varies from skills to spaces, the premise of gender inequality remains as a baseline.

At the same time, there are hidden advantages to these varying models of women in IT. Sometimes it is difficult to see those benefits in single organizations, and for this reason, transnational methodologies provide us with a unique glimpse into the process (Charles and Bradley 2006; Mukhopadhyay 2005; Poster 2005b). By comparing these case studies, we see how IndCo is more adept at getting women into engineering and technical work, while AmCo is more adept at promoting women into IT management.

I explain these differences in terms of varying micro-organizational dynamics, but also in terms of varying broader socio-structural influences pulling women into high-tech work. In India, the state has provided more support for IT educational institutions and structural access to help advance women into these jobs. This has meant that women's wages in IT jobs are generally higher than in other similarly skilled professions. On the other hand, the United States has a stronger political movement of women activists and professional organizations, which help to promote gender equity and hold firms accountable for their own written policies and public claims. This external network has improved wage equity and promotions for women in AmCo (especially relative to IndCo).

This comparative perspective raises a number of intriguing questions about the trade-offs of engineering and technical research for women.² Should Indian women act on the opportunities provided in IT—even if the gender gap in IT salaries (at firms like IndCo) is so high? Should women in the United States invest in extensive IT training, perhaps banking on the greater chances of upward mobility into management—even if they are less likely than men to land a job in engineering (at firms like AmCo)? This study points to possible strategies for reducing such quandaries for women. By recognizing and borrowing successful organizational practices from other IT settings worldwide, firms might take advantage of these hidden assets and transform local IT institutions. Future research should address how we can harness these sometimes subtle practices which can be so instrumental for women engineers and technical researchers.

Second, global circuits have the potential to undo some of the problems that women have been facing in IT. The transnational firm in my study, TransCo, was able to undermine some of the localized barriers for women in IT and create new policies by integrating the best of the work-family strategies from the United States and India. Yet, as my third finding reveals, global circuits have many dangers. Multinational firms provide an opportunity for managers to transplant new work cultures and hybridize multiple kinds of barriers for women in IT. While this analysis reveals dynamics occurring during the early stages of the global high-tech industry, future research will hopefully explore how these transnational dynamics have evolved and continue to shape women's careers in IT.

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Notes

¹ Company names in this study have been changed to preserve employee anonymity.

² I thank Judy Wajcman for helpful comments. Sole responsibility for content lies with me.

References

- Babco, Eleanor and Richard Ellis. 2004. *Women in Science and Technology: The Sisyphean Challenge of Change*. Washington, DC: Commission on Professionals in Science and Technology. www.cpst.org.
- Burris, Beverly H. 1993. *Technocracy at Work*. Albany, NY: SUNY Press.
- Catalyst. 2003. *Bit by Bit: Catalyst's Guide to Advancing Women in High Tech Companies*. New York, NY: www.catalystwomen.org.
- Charles, Maria and Karen Bradley. 2006. "A Matter of Degrees: Female Underrepresentation in Computer Science Programs Cross-Nationally." In *Women and Information Technology: Research on Underrepresentation*, edited by J. M. Cohoon and W. Aspray. 183–204. Cambridge, MA: MIT Press.
- Chhachhi, Amrita and Renee Pittin. 1996. "Multiple Identities, Multiple Strategies." In *Confronting State, Capital and Patriarchy*, edited by A. Chhachhi and R. Pittin. 93–130. New York, NY: St. Martin's Press.
- Cohoon, J. McGrath and William Aspray, eds. 2006. *Women and Information Technology*. Cambridge, MA: MIT Press.
- Committee of the Indian National Science Academy. 2004. *Science Career for Indian Women*. New Delhi, India: Indian National Science Academy. <http://www.ias.ac.in/womeninscience>.
- Fletcher, Joyce K. 1999. *Disappearing Acts: Gender, Power, and Relational Practice at Work*. Cambridge, Ma: MIT Press.
- Frehill, Lisa A., et al. 2007. "Women in Engineering: A Review of the 2006 Literature." *SWE Magazine*, www.swe.org 53(3):1–24.
- Hacker, Sally L. 1981. "The Culture of Engineering: Woman, Workplace and Machine." *Women's Studies International Quarterly* (4):341–353. [http://dx.doi.org/10.1016/S0148-0685\(81\)96559-3](http://dx.doi.org/10.1016/S0148-0685(81)96559-3)
- Hafkin, Nancy and Sophia Huyer, eds. 2006. *Cinderella or Cyberella? Empowering Women in the Knowledge Society*. Bloomfield, CT: Kumarian Press.
- Information Technology Association of America. 2005. *Untapped Talent: Diversity, Competition, and America's High Tech Future*. Arlington, VA: ITAA.
- Kelkar, Govind, et al. 2002. "IT Industry and Women's Agency: Explorations in Bangalore and Delhi, India." *Gender, Technology and Development* 6(1):63–84. <http://dx.doi.org/10.1177/097185240200600104>
- Kelkar, Govind, et al. 2005. "Women's Agency and the IT Industry in India." In *Gender and the Digital Economy: Perspectives from the Developing World*, edited by C. Ng and S. Mitter. 110–131. New Delhi, India: Sage.
- Lamont, Michele and Virag Molnar. 2002. "The Study of Boundaries in the Social Sciences." *Annual Review of Sociology* 28:167–195.

<http://dx.doi.org/10.1146/annurev.soc.28.110601.141107>

- Massey, Doreen. 1996. "Masculinity, Dualisms, and High Technology." In *Bodyspace*, edited by N. Duncan. 109–125. London: Routledge.
- Massey, Doreen, et al. 1992. *High-Tech Fantasies*. London, UK: Routledge.
- McIlwee, Judith and J. Gregg Robinson. 1992. *Women in Engineering: Gender, Power, and Workplace Culture*. Albany: State University of New York Press.
- Mukhopadhyay, Carol. 2005. "The Scientific Gender Gap Should Be Considered Comparatively." *Anthropology News* March: 4.
- NASSCOM. 2006. "Knowledge Professionals Fact Sheet." www.nasscom.in. Retrieved July 15, 2006.
- National Network of Education. 2007. "More Engineering Students in India than in the United States." www.indiaedunews.net. Accessed June 8, 2007.
- National Science Foundation. 2007. *Women, Minorities, and Persons with Disabilities in Science and Engineering*, www.nsf.gov/statistics/wmpd. Arlington, VA: Division of Science Resource Statistics.
- Ong, Aihwa. 1999. *Flexible Citizenship: The Cultural Logics of Transnationality*. Durham, NC: Duke University Press.
- Parikh, P.P. and S.P. Sukhatame. 2002. *Women in the Engineering Profession in India: The Millenium Scenario*. Bombay, India: Indian Institute of Technology.
- Peterson, V. Spike. 2003. *A Critical Rewriting of Global Political Economy: Integrating Reproductive, Productive, and Virtual Economies*. London, UK: Routledge.
- Poster, Winifred R. 2005a. "Organizational Change, Globalization, and Work-Family Programs: Case Studies from India and the United States." In *Work-Family Interface in International Perspective*, edited by S. A. Y. Poelmans. Mahwah, NJ: LEA Press.
- 2005b. "Three Reasons for a Transnational Perspective on Work-Family Policy." In *Work and Life Integration: Organizational, Cultural, and Individual Perspectives*, edited by E. E. Kossek and S. J. Lambert. 375–400. Mahwah, NJ: LEA Press.
- 2008 "Filtering 'Diversity': A Global Corporation Struggles with Race, Class, and Gender in Employment Policy." *American Behavioral Scientist* 52(3): 307–341. <http://dx.doi.org/10.1177/0002764208323509>
- Poster, Winifred R. and Srirupa Prasad. 2005. "Work-Family Relations in Transnational Perspective: Case Studies from India and the United States." *Social Problems* 52(1): 122–146. <http://dx.doi.org/10.1525/sp.2005.52.1.122>
- Sassen, Saskia. 1998. *Globalization and Its Discontents*. New York: The New Press.
- Sassen, Saskia. 2000. "Women's Burden: Counter-Geographies and the Feminization of Survival." *Journal of International Affairs* 53(2): 503–524.
- Saxenian, AnnaLee. 1994. *Regional Advantage: Culture and Competition in Silicon Valley and Route 128*. Cambridge: Harvard University Press.
- Scott-Dixon, Krista. 2004. *Doing IT: Women Working in Information Technology*. Toronto, Canada: Sumach Press.
- UNESCO Institute for Statistics. 2006. "Women in Science: Under-Represented and Under-Measured." *Bulletin on Science and Technology Statistics* 3(November):1–7.
- Wajcman, Judy. 1991. *Feminism Confronts Technology*. University Park, PA: Pennsylvania State University Press.
- 2004. *TechnoFeminism*. Malden, MA: Polity Press.
- Woodfield, R. 2000. *Women, Work, and Computing*. Cambridge, UK: Cambridge University Press. <http://dx.doi.org/10.1017/CBO9780511488948>

Résumé

Ce projet porte sur les expériences des femmes dans les carrières de l'ingénierie et la technologie, à une époque qui est de plus en plus 'transnational.' Il s'appuie sur une étude par enquête menée au cours des premiers pas de développement de l'industrie high-tech mondiale, avec plus de 180 femmes et hommes informaticiens dans trois contextes organisationnels: une entreprise informatique majeure de la Silicon Valley, sa filiale multinationale en Inde, et une société locale en Inde. L'industrie des technologies de l'information (IT), je trouve, a créé de

nouvelles possibilités d'emploi pour les femmes au niveau 'transnational,' mais a aussi demandé des compromis inégaux. Ce qui est surprenant est le fait que les «cultures de l'ingénierie» dans le milieu masculin, souvent mentionné dans la littérature américaine, sont plus faibles dans les cas de l'Inde. Ces femmes sont moins remises en question quant à leurs compétences techniques et ont un meilleur accès aux emplois tels que l'ingénierie. Dans le cas américain, cependant, les travailleuses sont plus susceptibles de devenir des cadres dans le domaine de l'informatique et reçoivent des salaires comparables à ceux de leurs collègues masculins. J'attribue ces résultats à la politique en cours dans le contexte de la technologie de l'information dans les sociétés indienne et américaine, et à leurs effets contradictoires à la fois pour attirer les femmes vers les professions de l'informatique et les exclure des structures de pouvoir de l'organisation. De plus, j'utilise le cas de la multinationale pour explorer ce qui se passe dans les circuits mondiaux entre divers sites de travail, et comprendre comment ils peuvent limiter ou exacerber les différents environnements hostiles pour les femmes.

Resumen

Este artículo enfatiza las experiencias de las mujeres en tecnología e ingeniería en una creciente era transnacional. Se basa en un estudio con entrevistas llevado a cabo durante las primeras fases de la llamada industria de alta tecnología, con 180 hombres y mujeres que trabajan en el campo de la tecnología informática (IT) en tres ámbitos: una compañía grande en el Silicon Valley, su subsidiaria multinacional en India y una compañía local en India. Encuentro que la IT ha creado espacios transnacionales de empleo para mujeres, pero con variados resultados. Sorpresivamente, la "cultura masculina de ingeniería" presente en la literatura USA es *débil* para el caso de la India. Estas mujeres en India confrontan menos cuestionamientos a sus experiencias en tecnología y obtienen mejor acceso a trabajos tales como ingeniería. Sin embargo, en el caso de USA, las mujeres trabajadoras tienen más posibilidades de convertirse en gerentes en IT y reciben salarios similares a sus pares varones. Situó estos hallazgos en el contexto de las políticas de tecnología informática en las sociedades USA e India, y sus efectos contradictorios a dos niveles, por un lado llevando a las mujeres a la fuerza de trabajo en IT y al mismo tiempo excluyéndolas del poder organizacional. Además, uso el caso multinacional para explorar lo que pasa en los circuitos globales entre estos espacios y ver si ellos debilitan o exacerban diversos escenarios de trabajo adversos para las mujeres.