Technological Change & Employment Relations in India

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This article provides an overview of the consequences of technology change on employment relationship in India. New technologies opened up employment opportunities in new and emerging sectors. Skills needed have undergone a change from that of manual dexterity and physical strength to those of trouble shooting and process handling. Group based incentivization and company specific bargaining are becoming more common. Unions no longer resist technology change but are concerned with the implications on the number of jobs, their content and earnings. It's also argued that subjective norms need to be considered as a variable influencing the behavioural intentions of workers with respect to acceptance of technology change. Implications for practice and future research directions are also discussed.

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Three Transformation Stages

The technological progress over the last century has undergone a slow but definite transformation. This can be categorized into three different stages viz. craftsmanship, mechanization and automation (Datta 1990). Each of the stages had an influence on the nature of work and the skill level required to perform a job. The early craftsmanship was characterized by the worker/craftsman having control over the entire production process, from procuring the raw materials to the finished goods. This required end-to-end knowledge, where the worker got involved in activities right from pitching to potential customers to delivering the final produce/service. Each product/service could be characteristically unique as each reflected the skills of the employee. This model of operation can still be found in some of the present day service firms, what are termed as Service Complexes and Service Shops (Davis 1999). The second stage of mechanization was brought about by the application of principles of scientific management where tasks were broken down to simpler and specialized ones for large-scale production of standard goods, and methods of estimating

a 'proper day's work' for the worker were developed. This required a complete reorganization of the methods of production. The role of the individual worker transitioned from a highly skilled one in the craftsmanship era to being considered one of the 'factors of production'. Mechanization also created a new portfolio of occupations such as engineers to design and produce the mass production machinery, the machine builders and tool makers and a wide range of skilled machine operators. The third stage of automation not only carried forward many of the features of mechanization but also qualitatively changed the way the worker undertook his/her job. The worker no longer directly got involved in the production process but monitored and maintained machines and helped in trouble shooting. This necessitated the worker understand the production process and the machinery rather than using his skill to turn out a product.

Technological change especially through automation has both advantages and disadvantages (Datta 1990, Datta 1996). Automated systems allow few skilled individuals to do the work, which previously required numerous unskilled and semi-skilled workers. They also allow tasks that are beyond human capabilities or those dangerous or monotonous jobs that would be considered inhuman for people to perform. Further the labour intensive ways of production are expensive and restrict the market for the product, which has a negative effect on the employment in the long run. Automated systems tolerate few or no errors and hence lack the inherent human flexibility in production.

Technology need not be restricted to just technical automation but can also involve a whole package of resources like capital, entrepreneurship and management (Virmani 1990). Further, technology as such is not quantified but what is quantified are those relating to its manifestations like a particular technique of production, productivity of a particular input, scale economics etc (Majumder 2001), e.g. in Singh & Nandini (1999) technological change at the firm level is operationalized in terms of R& D expenditure, technical collaborations and quality certifications, while Dhanaraj (2001) has taken gross fixed assets and value of plant and machinery to assess the impact of technology on worker wages.

With the liberalization of Indian economy in 1991 a number of private players started carving a major role in the economic output and simultaneously governments both at the centre and state levels started assuming a smaller role in running businesses. Increased domestic and foreign competition resulting from the economic reforms induced domestic manufacturers to improve efficiency and bring into use advanced technologies on a larger scale (Goldar & Kumari 1999). This is supported by the fact that during the period 1991-98 there were about 3250 technical approvals in India with the top five technical collaborators (Kumar Ajay 1999:1001). The subsequent break down of trade barriers, globalization, advancements in Information and Communica-

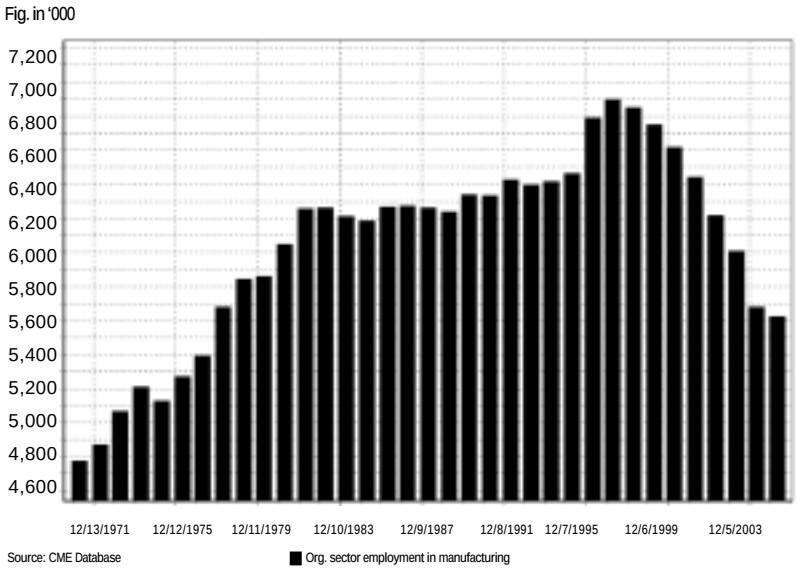
tions Technology (ICT) and well accepted management ideas such as TQM on quality, JIT, Computer Integrated Manufacturing(CIM) & Lean Production(LP) have served to magnify the impact of technology on employment relationship globally and India in particular.

Employment in Organized Services sector has been picking up in the latter half of last decade and early part of this decade.

Technological Change & Employment

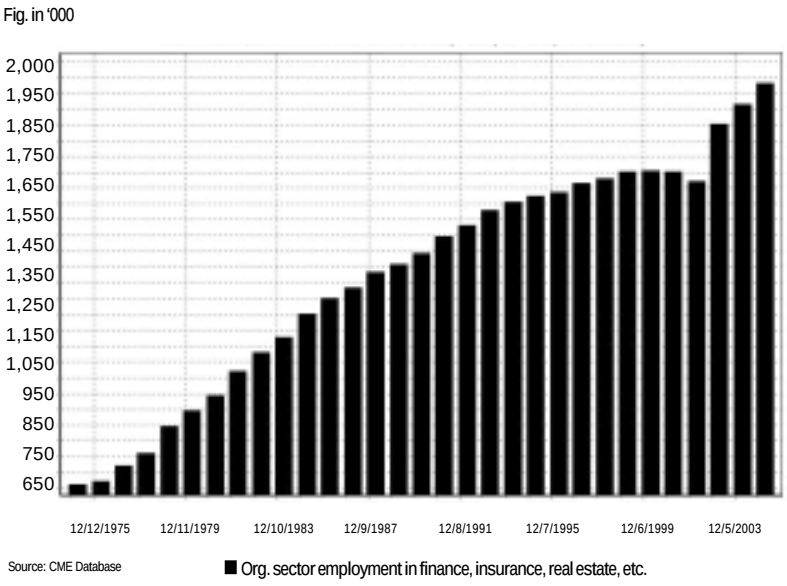
Labour employment is affected by many factors, two major directly relevant factors are per unit labour requirement for a product (man hours per unit) and the total demand for the product (Kumar Arun 1999:806). It is likely that technological improvement leads to reduction in per unit labour requirement but at the same time because of the increased demand made possible by the lesser cost of the technologically advanced product, it can lead to rise in overall demand for labour. This expected rise in demand for labour has however not been equally true for all sectors/ industries. In a study of employment in organized manufacturing sector in India, it was found that even though real gross value added has grown at 7.4 percent per year during 1981-2002, employment of workers increased only by 4.3 and most of this growth happened in the early part of the 90s while the latter half of 90s and early part of the current decade have shown a reducing trend in organized manufacturing sector employment (Nagaraj 2004). At the same time, employment in Organized Services sector has been picking up in the latter half of last decade and early part of this decade. As could be seen in figures 1-3, organized manufacturing sector seems to have shown a sharp decline in employment post 1996 while services have gained during this period.

Figure 1: Employment in the Organized Manufacturing Sector



Further even within the same

Figure 2: Employment in the Organized Services Sector (Finance, Insurance, Real Estate etc)



industry, there seems to be a shift in the occupational and work profile of the employees. As a consequence of technological modernization of banks it was found that though there was an overall increase in employment, this growth has been made possible by an emerging volume of employment in hitherto new areas such as systems analysts, console operators etc (Datta 1990). In a case of technology transfer to an Indian engineering MNC from its foreign parent company during the period 1974-1984, even though the fixed capital increased by about 400 percent, the number of workers actually decreased by 8 percent whereas the total employment increased by 35 percent, indicating a shifting of workforce from workers to supervisory and executive cadres and a corresponding shift in the skill requirements (Virmani 1990). In an aggregate study of the organized manufacturing sector for the period 1982-2002, it was found that the increase in gross value added is accompanied by greater employment of employees in the supervisory cadre as against the worker cadre (Nagaraj 2004). Further there has been a change in demand for the type of employees within the same occupational group, from operatives and labourers to professional and technical workers in many of the industries such as Banking (Datta 1990, 1996), Software Services (Singh & Nandini 1999) and Textiles (Chakravarty 2002, 2006, Dhanaraj 2001).

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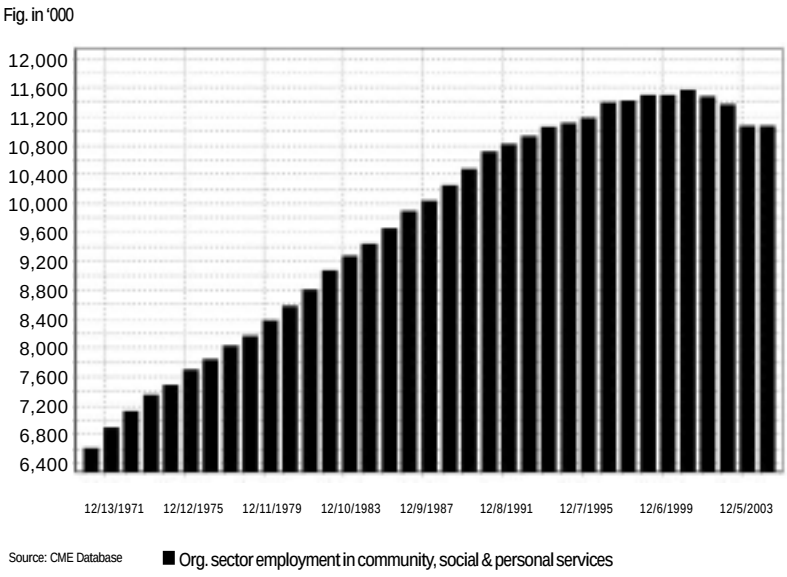
Impact on Skill Profile

As the manufacturing and service technologies continuously develop like in the case of just-in-time inventory, manufacturing cells, robotics and service quality concepts etc, there is an increasing pressure on the organizations to

Figure 3: Employment in the Organized Services Sector (Community, Social & Personal Services)



implement team based work designs. Hence the technological changes almost always are followed by a corresponding change in the essential work structure of the organization. Organizations have become increasingly flatter and work unit in most organizations is no longer an individual but is a team. Hence there is an increasingly felt need to foster the skills and attitudes to function as an effective team player.

The impact of new technology on skill requirement in the textile industry has been widely reported. Textile industry in India has a special place with 4 percent contribution to the GDP and 12 percent of the world's textile production (GOI 2009). The cotton mill workers account for 20 percent of the total employment in the manufacturing sector (Chowdhury 1996) and the textile industry is the largest contributor after agriculture to the employment providing jobs to about 21 million people. When new types of technologically advanced looms were introduced in textile firms, the skill requirements changed to those of monitoring and troubleshooting of the production process instead of directly getting involved in the production (Chakravarty 2002, 2006, Datta 1996). This is because with the introduction of new automated machinery, the technologies are no more separate from each other and detection of faults requires a thorough understanding of the production process and familiarity with different equipments used (Chakravarty 2006). Hence the skill required for the job, which previously emphasized manual dexterity, physical strength in manual and repetitive tasks has been taken over by the need for machine trouble shooting and process handling skills. The roles and responsibilities of the senior workers were more flexible in the modernized mills and they were expected to handle a higher number of departments compared to rigid and specific allocations along different categories of work within a department in the non-modernized mills. This change is just not restricted to in

troduction of new production processes but may be related to even initiation of new management ideas. For instance, at the beginning of the nineties, when Motorola started measuring workers' performance against quality & outputs instead of measuring against a time clock, it became necessary for its workers to know their equipment and production process, and be able to initiate any trouble shooting process themselves which were previously not in their ambit (Wiggenhorn 1990). This required the worker to unlearn deeply held attitudes and values when they were just responsible for working on individual machines to those of understanding the production process as a whole.

Impact on Wages

The impact of technological change on wages has been mixed. Budhwar (2003) in his study of 137 Indian firms in six manufacturing sectors in India found that collective bargaining and provisions of labour laws have a significant influence in determining the basic wages and bonuses of blue-collared employees, hence indicating that the wages are still determined by factors not directly related to individual/firm performance and technological change. However, this is also sector specific. In a study by Singh & Nandini (1999) in the software industry, it was found that technological change does have a significant effect on salaries paid to employees. Chakravarty (2002) in her study of spinning mill workers found that the modernized mills required 'unusual skills' from workers compared to the traditional ones and they also had higher wages due to the greater dependence of the organisation on these workers. However, the effect of increased investment in technology on wages has not always been positive. Virmani (1990) in his study of the Indian subsidiary of a MNC found that the wages as a proportion to value-added remained at about twelve percent and has not changed significantly with the introduction of new technology over the years. Further, Ajay Kumar (1999) in a study of sixty select MNCs, found that the aggregate rise in wages and salaries, was much lower than the aggregate increase in operational expenses, suggesting that the growth rate of wage bills has not kept pace with investment in operations.

The impact on wages because of technology change is also influenced by the political process. Betcherman (1991) argues that there is a positive correlation between wage levels and introduction of advanced technology but how the pie is distributed will depend on the balance of power between the negotiating parties. In the Canadian context, he found that skilled blue-collared workers, both unionized and non-unionised, could bargain a higher pay compared to those doing manual work. Further, the union's bargaining power was lower for technology innovators than among non-innovators. In a similar vein, in the case of modernized textile mills in India there is an emergence of distinct and firm specific skills which require higher cost and time investments (Chakravarty 2002). Hence companies are willing to pay higher wages in these mills as contrasted

to non-modernised mills. This necessitated decentralized bargaining in the case of modernized firms while the non-modernised ones went in for industry wide bargaining. In the latter case since the skills are not specific to an organization but rather are generic to the industry they required support of the wider political base. Nagaraj (2004) in his study of employment in organized manufacturing sector notes that while real wages of workers have roughly stagnated during 1981-2002, the real emoluments of supervisors have gone up by 77 percent during the same period indicating that the increase in wages due to technology change has not been so favourable to the workers in general.

Worker Acceptance

The reasons for introducing new technology vary from one organisation to another. New production system in a plant is brought in by the management typically in response to the change in market conditions, which require more 'efficient' technologies to be adopted (Datta 1996). Studies have indicated that the technological improvements/changes lead to improved productivity, lower costs and better work environment (eg: Virmani 1990, Datta 1990). The improvement in productivity seems to hold for varied sectors from Heavy Electricals (Virmani 1990), Software (Singh & Nandini 1999), Textiles (Chakravarty 2002, 2006, Dhanaraj 2001) and Banking (Datta 1990, 1996). Studies indicate that after a time lag major technological changes have always induced significant changes in the organisation processes (Gurtoo & Tripathy 2000) and the success of new technology is dependent on the extent to which the workforce is willing to adapt to the technological and organisational changes (Dayal & Aggarwal 1995, Gurtoo & Tripathy 2000:520).

Davis, Bagozzi & Warshaw (1989) have proposed a theoretical model for a better prediction and explanation of end-user acceptance of technology and is called Technology Acceptance Model (TAM). This proposes that one can predict technology acceptance of employees by knowing their behavioural intentions, which in turn are influenced by attitudes, perceived usefulness of the technology and ease of use of the same. In their longitudinal study of 107 users to predict computer acceptance, it was found that perceived usefulness was able to explain more than half of the variance of behavioural intentions after 14 weeks and perceived ease of use though small, was significant enough to explain the behavioural intentions.

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The importance of employee acceptance of new technology and also the adaptability to change has been highlighted in the study by Datta (1990) on the introduction of computers in the Indian Banking Sector in the 1970s and 1980s. The study indicates that a key factor in the acceptability is by taking

the unions and the employees into confidence before introduction of automation. This was done through a free flow of information, education and training of employees in terms of what computerization means and what changes it can bring in. The transformation of Bank of Baroda from a large public sector bank with a legacy culture to a highly customer centric, technology driven bank through a variety of initiatives including implementation of Core Banking solutions is credited to clear and transparent communication with the employees (Khandelwal 2007). Studies in the Indian context have shown that attitudes in terms of job satisfaction and freedom and autonomy at the work place were found to be significantly positively related to technology acceptance (Gurtoo & Tripathy 2000, Venkatachalam & Velayudhan 1999). Venkatachalam & Velayudhan (1999) in their study of a steel plant found significant and positive correlation between meaningful, interesting job and technology, indicating that new technology introduction does have an influence on how the employees feel at work.

Unlike in the West Indian employees rarely differentiate the work and social roles and it would be possible to develop a feeling of "we-ness" if policies and practices instil among employees the feeling of 'acceptance and belonging' (Dayal 1999:220). As Khandelwal (2007: 210) observes "I always felt that employees were equally concerned as stakeholders about declining business at the bank. I also felt that they did not exactly endorse the attempts of trade unions to stymie technology or other customer-centric initiatives. It was with this belief that we reached out to 40,000 employees directly through a monthly letter and numerous employee meetings across the country sharing problems of bank business and seeking their engagement." However this belief and actions associated with it seems to be an exception rather than the norm. Budhwar (2003) found that strategic and financial information are comparatively less shared with the blue-collared workers than with the white-collared workers, due to low faith of management in their subordinates, preference of managers for centralized decision making and control, and lack of awareness by the employees. Further, it is found that 87% of the employees communicate through their immediate supervisors and also that most of the communication is done through staff bodies. Such results suggest that any successful technological change has to be accompanied by a continuous and consistent communication with the employees, sharing both developments and concerns on the business front and the need for new technology implementation and its implications for employees. Further engaging supervisors and staff unions in the communication process are likely to bolster efforts of management.

Union Response

In the British context Manwaring (1981) found that the union response to introduction of new technology varies as per the likely effects of the new technology, the importance of the new skills

introduced by the technology and the impact on bargaining power previously established. For the unions the new technology has implications for the number of jobs, their content and the earnings that it is going to affect. In the Indian context, in a study of 'unusual' collective agreements in the public and private sectors Ratnam (1991:17) found that unions no longer resist changes in work practices resulting from modernization or computerization except in the case of employment of contract workers and restrictions on subcontracting. In the case of Indian Aluminium Company Limited, Belur, "It is agreed that the right to plan, direct and control operations of the plant, to introduce new or improved production methods, to expand production facilities and to establish production schedules and quality standards are solely and exclusively the responsibilities of the management. The management's authority to perform these and other duties will be respected in every case" (Ratnam 1991:32). In the case of modernization of Indian Iron and Steel Company, Burnpur, thirty options were considered and discussed with all the unions through extensive sharing of information and the option adopted was to close down six plants and retrain and redeploy five thousand surplus workers instead of retrenching them. Even though there were no discussions on the specific technology to be used, the consequences of modernizations were discussed in detail with the unions. With respect to the introduction of computers in the banks, the initial agreement between the Indian Banks Association and the employee associations such as AIBEA and NCBE signed in 1983 defined the extent, the purpose, the branches and the allowance to employees because of computerization, while the second one signed in 1987 extended the first one in defining the type of technology that is to be used, guarantee of no redundancies and even unusual clauses such as pregnant women can refuse to work in new computer work stations. In the case of Minerals and Metals Trading Corporation Ltd it was agreed that if the unions resist implementation of the program of computerization, the benefits flowing under the settlement shall not be considered for these members.

Subjective norms need to be considered as a variable influencing the behavioural intentions of the workers with respect to acceptance of technology.

The influence of trade unions on blue collared worker behaviour is also significant. For example, Datta (1996) in his study of the introduction of advanced looms in a textile factory in Bombay found that the union had a say on who would work on the new technology and even the number of machines that are to be handled by a worker. Although subjective norms were not included in TAM, in order to study technology acceptance by workers especially in the Indian context, subjective norms need to be considered as a variable influencing the behavioural intentions of the workers with respect to acceptance of technology. Subjective norm here refers to "the person's perception that most

people who are important to him think he should or should not perform the behaviour in question" (Fishbein & Ajzen 1975:302 as in Davis et al 1989). Since in the Indian context, trade unions do have an influence on the individual's behaviour manifested as peer influence and superior influence (Mathieson 1991), it would be necessary to consider subjective norms as well. Further, another important consideration in accepting new technology is the perceived behavioural control which is the belief that the employee has access to and control of resources for the running of the technology/machinery. In the worker context, these are essentially external factors that get manifested in terms of colleague cooperation to get a job done, access to commonly shared resources etc. Depending on the importance that an employee attaches to the opinions of his colleagues as a consequence of his common group membership or otherwise, the views of the group/union, he/she is part of, would matter as well.

Implications for Practice

The above mentioned literature review throws open quite a few practical implications. To begin with, there would be a need for anticipating and planning the skill needs because of introduction of new technology. The issue of retraining, necessitated by the introduction of new technology had not been sufficiently addressed. Although the government had instituted National Renewal Fund (NRF) as a social safety net with one of the purpose being to retrain the workers with obsolete skills in both private and public sectors, most of the money was spent in compensating the public sector workers through the voluntary retirement schemes (Chowdhury 1996). People with obsolete skills would need to be retrained and accordingly the training department would have to be equipped. This would impact not only the number of training programs undertaken but also the content of these programmes. Over the years there has been increasing money spent on training and development of the organized workforce in India (Budhwar 2003). Two focus of the training programs for the workers to cope with the changing technologies are in the areas of skill and attitude training.

With technological modernization, not only have the quantum of routine, repetitive jobs reduced but also the different units and jobs associated with production have become more integrated and more complex (Chakravarthy 2006). Detection of a source of fault requires a more thorough understanding of the production process and familiarity with the different machines used. Hence the line of duties between the different categories of workers has become blurred. Because of this varied and unspecified nature of skills, development of these skills are mainly through long on-the-job training like mentoring, learning by doing and advice from more experienced colleagues with short off-the-job training (Chakravarty 2002, 2006). Since the 'standardized' part of the skill content is low, a large part of the training process becomes intangible and hard to measure and monitor. The time intensive

nature of training coupled with its intangibility places high importance on retention of the permanent workforce to the firm and this is corroborated by empirical evidence. The process of skill formation has become internalized and both the management and the workers have a valuable stake in developing a long-term relationship.

In attitude training the focus is on developing a mind-set of mutual interdependence and co-operation. With the increasing non-separability of the machinery and introduction of management ideas such as TQM, the organization's performance has become increasingly reliant on interdependent and co-operative performance of its workforce. Participative requirement was not such a necessity in the pre-reform days as increase in productivity was not at a premium (Ghose 1994). This has changed in the past two decades in India. In the 1990s, because of liberalization not only have new players entered various markets but they brought with them new technology and way of work. This placed a premium on existing players to focus on cost and quality to compete effectively. TQM was one such effort. In TQM, employees are provided with business information on performance and environment with the necessary training so that they can understand the information and are empowered to act on it. Employees can then relate their work to job security, customer satisfaction and market share. These connections contributed to cooperation in quality improvement initiatives. In the past one decade, because of globalization, reduction in trade barriers and advancements in Information and Communication Technology, firms have increasingly woken up to realize that their competition is not just restricted to their immediate neighbour but is global. All these have placed more emphasis on co-operative and interdependent efforts.

Further, prior to the introduction of a new system, it would be helpful to understand the acceptability of the system to the end-users and the key variables provided by Davis et al, (1989) would help in this regard. In the case of a union set-up at the workplace a sound relationship between the union and the management based on acceptance of legitimacy of each other is a base condition before engaging each other in discussing the introduction of a new technology. As is seen in the Eicher restructuring experience, with conducive industrial relations climate and trade union involvement, it is possible to have distinct changes in the production system without retrenchment or lay-off of workers (Ghosh 1995:212). Further educational programs designed to persuade workers of the positive fallout of introduction of a new technology does directly influence the perceived usefulness and indirectly help workers through ease of system use. (Davis et al 1989, Wiggenhorn 1990).

Group payment schemes are increasingly becoming common and would have to be considered for ensuring fair rewards. The study of the workload distribution and duties amongst the textile workers found lot of overlaps of duties between the workers, jobbers, supervi

sors and the management (Chakravarthy 2002) in automated textile mills and this was reflected in a higher emphasis on group based incentive pay in these automated mills. Also because of the previously cited time intensive and intangible nature of skill development, seniority is likely to be rewarded with skill premium. Traditional industry based trade unionism would lose relevance and company specific unions which are more focused on the productivity wage gains are becoming more prevalent. Hence the pay needs to be aligned to this changed reality where it would become more and more difficult to have only individual pay and incentives and these become more group based and organization specific in characteristics.

Due to the changing profile of the workforce towards technical and skilled manpower because of changing technologies (Datta 1990, Chakravarty 2002, Virmani 1990), the expectations of the employees are also likely to change (Dayal 1999). Apart from 'hard' issues like salary/wages and service conditions which have been a major part of the union/management negotiations, 'softer' issues like job satisfaction, job progression, work autonomy etc would gain increasing prominence.

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Employee discipline in terms of attendance and regularity of the worker is also another crucial factor in the introduction of automated technology. Economic viability of capital-intensive technology requires that they be run at high capacity levels. As was found by Datta (1996) the introduction of the microprocessor based looms required them to be run at 90-92 percent capacities. With the changing technologies it is expected to change the workload distribution, duties and responsibilities. In a typical organisation with union presence, handling employee discipline is mediated by the mechanism of collective bargaining. Hence the change in technology will have the effect of change in contractual relationship between work unions and the management and managers need to be geared to meet this situation.

Directions for Future Research

Many studies in the Indian context have adopted a case study approach in identifying the issues related to industrial relations due to technological changes, and even amongst these textile sector predominates in their analysis. Chakravarty (2002), Chowdhury (1996), Dhanaraj (2001), Datta (1996) have all focused on the textile workers. Few case studies Virmani(1990), Venkatachalam & Velayudhan(1999), Singh and Nandini (1999) have focused on impact of technology on employment and employee relations in other contexts. It is suggested that the level of automation in continuous process industries is much higher compared to those in mass production and craft based industries. Hence generalising the results obtained in a mass production context like those of textiles to continuous process

industries like chemicals, refineries, liquid food processing etc may not be practical. Further the level of unionization in the textile industry is much higher compared to other sectors.

Conclusions

Introduction of new technology has been mandated by the need to respond to competitive market conditions. Indian industry has in the last couple of decades been able to proactively respond to market demands and introduce significant changes. Co-opting the workforce in this change has borne fruit for many companies while some have faltered on this ground. There also is a social cost to these change efforts and management may be best advised to consider these aspects for the future.

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