Work and Efficiency in Cotton Mills: Did the Indian Entrepreneur Fail?

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Abstract

What explains the low productivity of Indian cotton textile workers, compared to workers in other countries such as the UK and Japan? Clark and Walcott argue that it is the low effort level of the Indian worker, reflecting worker's relative preferences for low work intensity rather than income and union resistance to increased work norms. This paper suggests that two alternative explanations are more compelling. First, nutrition levels and living conditions were such that Indian workers may have been physically incapable of higher work intensities, in line with nutritional efficiency wage arguments. Second, effort and wages may have been inefficiently low, but managers failed to recognize the possibility of a Pareto improving rise in both. This may have been due to the separation of the managerial functions in Indian industry, where responsibility for work discipline rested with the jobbers, while the technical staff was mainly European. We also show that labour use per machine was not higher in the unionised Bombay mills, as compared to other regions, suggesting that worker resistance to increased effort cannot be an explanation for low productivity.

Why isn't the whole world developed? In his well known paper Clark (1987) compared labour productivity in cotton mills in different parts of the world and made a case that high wages were determined by high labour productivity. British workers used 3.8 plain looms per worker, New England producers 8, the Japanese 1.6 and the Indians 1.9. Japan made dramatic productivity gains in the next decades. In the 1920s, if output per spindle hour was 100, for the United States it was 105, for Japan 115 and for India 99.[1] More workers per machine in India did not increase capital productivity. In the 1910s and 1920s India employed 3.08 as many workers per loom for every worker in British cotton mills Individual spinners in Bombay attended 180-200 mules compared to 500-600 in Britain. Individual weavers in Bombay operated two looms. A weaver in Britain was responsible for 4-5 looms.[2]. Other estimates put the productivity of labour in Indian mills at less than half of the British counterpart. Although labour was cheap in India and Japan, the British industry continued to remain competitive as a result of high productivity of the workers. Underdevelopment in India and Japan in 1910 can be explained by the lower productivity of workers in cotton mills "Local" factors rather than economic ones determined the lower productivity of workers in India and Japan.

Clark's basic argument has been extended by Wolcott and Clark (1998) to explain the divergent trajectory of wages and productivity between Japan and India in the subsequent period. While Indian spinners worked one side of the loom and weavers operated two looms, Japanese spinner operated 3 sides of spinning frames and the

[1] Clark, 1987,
[2] Rutnagur 1927, p323.

number of looms per weaver was 55.[3] Wolcott and Clark argue that Japanese workers increased their work effort and were therefore able to earn higher wages. On the other hand, work norms in the Bombay cotton mill industry remained static. They attribute this failure to worker resistance to higher effort rather than the failure of managers to initiate changes in working practices. Wolcott's (1992) other work on the subject sees India's failure as a result of unionization and lifelong employment contracts. In this view, a labour force of young female workers gave Japanese industry a decided advantage in pushing through organizational changes and the resulting higher efforts

We are confronted with two questions: First, What were these "local effects" that caused the Indian workers to be less efficient? Second, why did the Indian industry not introduce the organizational changes made in the cotton mills in Japan?

In the literature we find two alternative explanations. First, the work culture of the Indian workers was different from that of the British counterpart. Incompetence and laziness are some of the explanations that have been used by both managerial staff in the industry, policy maker and foreign observers from the very beginning and indeed in recent years by academics, e. g. Clark and Wolcott, taking a fresh look at the historical evidence. The second explanation is rooted in differences in organization. Morris and Buchanan see managerial failure in the adoption more efficient working practices.[4] Wolcott and Clark rule out this explanation and focus entirely on the failure of the mill workers to increase the level of effort. Greater unionization of Bombay workers prevented the managers from introducing organizational changes. The workers showed

[3] Pearse.
[4] Morris 1965. Buchanan 1966.

resistance to work intensification. The evidence for this comes in terms of the strikes in Bombay mills in the 1920s.

This paper takes a critical look at these the arguments and offers new interpretations. I argue that wages and effort in cotton mills were products of the state of development of the wider economy. Wages in cotton mills were not determined by labour productivity in that sector, but reflected the national wage and the level of economic development. To compare differences in labour productivity, it is important to consider the differences between the British industrial worker and the Indian cotton mill worker. The former was a product of a hundred years of industrial development and high economic growth. The latter belonged to an underdeveloped agricultural economy. The Indian cotton mill worker had moved to the city of Bombay from the rural hinterland in search of better living conditions. The quality of work depended on the worker's nutritional level, level of education and familiarity with a factory discipline. The differences in economic growth in India and Japan may also explain the early implementation organizational change in Japan. With economic growth, wages in Japan increased rapidly. Faced with high wages, cotton mill industry introduced changes in work practice. In a sluggish economy, such as India, wages did not rise much until the First World War. The cotton mill entrepreneur faced little pressure for change. This paper presents evidence that although Bombay cotton mills had a militant workforce, there was little difference in labour use per machine in the cotton mills in comparison with other regions in India. Over manning in the cotton textile industry was an organizational choice given the low wages in the economy and does not necessarily reflect workers resistance to an increase in effort.

Work and Organization in the Cotton Mill

The development of cotton textile production in India was an indigenous enterprise. In 1851 a Parsi merchant in Bombay began to explore the possibilities of import substitution in cotton textiles. Following his correspondence with Platt Bros., the machinery producers, the first spinning mill was set up in 1854.[5] Indian investors did not shy away from investing in the main import substituting activity, where they faced direct competition from imports from Lancashire. The next fifty years saw entry of new firms, a few British, but the majority were Indian. Some went bankrupt within a few years, many survived and prospered. The domestic cotton textile factory industry saw impressive growth without any kind of support from the government, a feature quite unique in the context of late industrializing countries. The main output was yarn for the domestic handloom industry and also for export in the Chinese market. Over time spinning mills bought their own looms and began producing cloth. The advantages this industry enjoyed were cheap labour and a local supply of raw material. The industry adopted a new institutional form of management that was common in other Indian industries. One agent was responsible for managing many firms on the basis of long tern agency contracts. The managing agency system filled the gap between the potential investor and the productive activity. The Indian managing agent raised capital and managed the financial side of the business for a commission. The production itself was left in the hands of technical supervisors, many of whom were from Lancashire and labour supervisors known as the jobbers, who were locally recruited.

The agents mostly came from the merchant class and had little technical training. They relied initially on the men from Lancashire for the technical side of production.

[5] Rutnagur, 1927, p9

Among the different social groups in India, many from the Parsi community trained as technicians and filled an important gap in the technical side of production. Table 1 shows the background of the directors and of technical staff in Bombay. The majority of the agency directors were Indians and came from a merchant class who had diversified into industry as profits from trade began to fluctuate.[6] In most firms, management was divorced from the technical side of production. However these technicians knew little about the labour market. A third tier came into the management structure: the jobber or the labour recruiting agent.

TABLE1: SOCIAL ORIGINS OF MANAGERIAL STAFF IN BOMBAYCOTTON MILLS

	TECHNICAL PERSONNEL		DIRECTORS 1925		
	1895	1925	MERCHANTS	TECHNICAL	LAWYER
PARSI	112	201	30	9	10
HINDU	21	67	74	0	3
MUSLIM	5	6	19	0	0
JEWISH	3	11	6	0	0
EUROPEAN	104	113	20	2	2

Source: Rutnagur, 1927, P 251-253

The process of hiring was a complicated task. India had abundant cheap labour, but mainly concentrated in agricultural activity. The industry had to draw its labour from the rural hinterland. The task was assigned to the jobbers, who typically came from the

[6] Morris 1965, chapter 3, Vicziany 1976

same social background as the labourers and used his rural connections to recruit workers for the textile mills. The demand for labour fluctuated with the state of the market. About one-fifth of the labour in Bombay cotton mills was employed on a daily basis.[7] The jobbers were given the responsibility of maintaining adequate labour supply to suit the level of demand and also to implement factory discipline. The production managers often did not have a common language of communication with the mill workers. It was the jobber who was assigned the task of worker management and to supervise that the task was being done well. The system has come under much criticism. It encouraged high labour turnover as the jobber exercised control over a readily available group of casual workers. [8] Many were corrupt and obtained side payments in exchange for providing employment. Chandavarkar argues that the jobber performed the useful function of maintaining labour supply in an industry fraught with fluctuating demand conditions.[9] The managers were keen to have flexibility in employment so that workers could be retrenched when demand was low, but could be hired with ease when the need arose. This was ideally met by the system of casual labour. The jobber could select workers to suit a particular task from the group gathered outside the mill gate. In the hiring and firing of workers, the jobber used social connections as a means of reducing conflict.[10]

Despite the presence of a large army of casual workers, it has been suggested that a group of workers who had migrated with families from far away regions provided a stable core in the industry and these permanent workers commanded a higher wage than a

[7] Chandavarkar, p82.
[8] Morris 1965, p129-30, Chandavarkar 1994, p108.
[9] Chandavarkar, p108
[10] Chandavarkar, p397.

single person coming from the Bombay hinterland.[11] Table 2 shows the wage- gap between the textile workers in Bombay and the rural hinterland. This higher wage reflected an opportunity cost of employment of wife and children in the rural community.[12] Bombay city rarely offered possibilities of employment for families of such workers. However, it must be noted that nearly 70% of the workforce came from within a radius of 200 miles from. This figure declined to 55% in 1921 and 42% in 1931 and the share of migrant workers from the distant villages of northern India increased from a mere 3% to 12% in twenty years.[13] The share of the local born in total mill worker population increased during the 1920s (see Table 3)

TABLE 2: RURAL- URBAN WAGE DIFFERENTIAL

YEAR	BOMBAY INDUSTRY AV. DAILY EARNINGS (PICE)	RURAL KONKAN FIELD LABOUR DAILY WAGE (PICE)
1900	90.76	37
1905	92.97	38
1910	114	47
1915	17	58
1920	123.69	77
1925	241.85	111
1930	255.21	114
1935	201	72

Source: Mazumdar, p495

[11] Mazumdar 1973.
[12] Ibid.
[13] Morris, p63

TABLE 3: LOCAL BORN IN THE POPULATION OF BOMBAY AND AMONG MILL WORKERS (%)

YEAR	TOTAL POPULATION	MILLWORKERS
1872	31.1	-
1901	23.4	-
1911	19.6	10.92
1921	16.0	18.87
1931	24.6	26.33

Source: Chandavarkar, table 14, p149.

Choice of technology

The Indian cotton mill industry adopted the mule instead of the ring.[14] Output per worker was generally higher for the ring. The ring was also more suited to unskilled labour. India lagged behind Japan in switching over to the ring. Kiyokawa sees the lack of technical knowledge of the managing agents as a decisive disadvantage for India in contrast to Japan. He finds a correlation between the failure to adopt the ring and the presence of British technical personnel. Japanese managers had technical training and were able to take decisions themselves.[15]

[14] Inefficiency in cotton mills has been much debated. The ring vs. mule debate in the context in the British cotton mills focused on the question of entrepreneurial choice. Sandberg's influential paper argued that the British cotton mills chose the right kind of technology given the factor endowments. Lazonick's critique was built around the failure of British entrepreneur to make organizational change and bring about vertical integration. Saxonhouse and Wright see that the persistence of the mule in India and Russia in terms of the type of cotton used. These countries used short staple cotton, whereas Japan and Brazil adopted the ring much faster as these industries used long staple cotton as the input.

[15] Kiyokawa, 1983.

Other research in this field suggests that the Indian entrepreneurs made a rational choice in adopting the mule. In the slow adoption of the ring, it has been argued that the Indian entrepreneur was responding to the factor prices in the economy and the structure of demand for locally produced goods.[16] The cost of capital was high, whereas labour was cheap. The cost of capital stock in a cotton mill was 35% higher in India compared to a British mill. Up to the 1890s, the mule was cheaper. If rings were adopted only as mules were scrapped or for new capacity, then the rate at which rings were adopted would be slower. Even efficient mills, such as Sassoon, replaced machines only when it became absolutely necessary. Capital was the main constraint. Machinery was operated as long as possible. Equipment was repaired, parts replaced until it was essential to replace it. Many firms continued to order mules.

Each mill produced a variety of yarn depending on the state of the market. The mule allowed greater flexibility in operation. The mule was better suited to short-staple cotton which was produced in India. The use of short staple cotton also meant that breakage was high the workshop had to employ more men to each machine. The machines were also operated at a higher speed further increasing the number of men per machine.[17] It was estimated that a ringsiders in India had to deal with nine times as many breakages per 100 spindles as his American counterpart.[18] This labour intensive use of technology suited the wage-rental ratios facing the entrepreneur, but did not lead to increase in capital productivity.

In contrast the labour using technological innovation helped the Japanese industry to achieve productivity gains. Japanese industry brought about organizational changes as

[16] See Chandavarkar 1994 for a clear exposition of this view.
[17] Chandavarkar, chapter 7.
[18] Ibid.

the industry switched rapidly from the mule to the ring. Two labour using practices increased efficiency.[19] Mixing of cotton types- short and long staple made the introduction of the ring suitable. The Japanese entrepreneurs increased labour use per unit of capital as mixing required labour input and also introduced a system of double shift, which allowed the capital stock to be used more intensively. The Indian cotton textile industry did not introduce either of these changes. Local cotton was short staple and there was little incentive to import American long staple cotton for mixing. What is puzzling is the persistence of long hours of a single shift system. Although Indian mills often worked 12-14 hours day, Japanese mills worked as long as 22 hours in two shifts. Pearse has calculated an average cost reduction of 12% for yarn counts of 20s and 13% for yarn counts of 32s for mills working two shifts. Instead the Indian mill owners chose to run the machinery non-stop and have more workers per machine so that absence of workers from the machines could be staggered. The mill owners opposed introduction of a fixed lunch hour right up to the 1920s.

A few mills attempted introduction of double shifts in 1905 and there were a few instances of labour shortage for the second shift.[20] In 1919 BMOA decided against a proposal of a general introduction of double shift. One of the arguments against the system of double shift was the difficulty of providing housing and sanitation of an additional 100,000 men required for the second shift.[21] The reluctance of all mills to work double shifts seems to have been associated with greater costs of supervision. The pay of permanent managerial staff, often European was high and foreigners were typically given

[19] Otsuka et al., chapter 5.
[20] BMOA 1905, ITJ, Jan 1907
[21] BMOA, 1919-21

a three year contract. In the face of fluctuating demand this appeared uneconomical.[22] Several mill owners argued that mills on a double shift would bid up the wages and cause labour disputes in mills on single shift.[23] This, however, does not explain why individual mills did not find such a move profitable. Wadia of Bombay Dyeing, one of the efficient firms in the industry, was willing to go ahead with it despite opposition within the Association. Many complained about the unfair advantage enjoyed by Japan and attributed the system to absence of laws regulating. However double shift was not adopted until the 1930s.

Labour Productivity

Nutrition and Schooling

Let me begin with Clark's claim that worker quality in terms of stature and education cannot explain the differences in efficiency. The average mill worker in Bombay weighed 105 lbs at the turn of the century – certainly lighter than the average male artisan in Britain in 1878. But this did not affect work effort as strength did not matter in most tasks.[24] Is this contention valid?

In his evidence to the Indian Factory Labour Commission, Dr T.M. Nair dissented from the majority view that the physical condition was no worse than that of other labourers. Dr. Nair pointed to the higher incidence of tuberculosis among mill hands, particularly, the young operatives. The physical well being of a cotton mill worker was worse than that of a dockworker.[25] Dr. Krishnan practising in Bombay attributed the

[22] Morris, p56-57
[23] Chandavarkar, 353-354
[24] Clark 1987, p166
[25] ITJ

physical deterioration among the mill workers to bad ventilation and alcoholism.[26] On average a worker was absent 4-6 days in a month. The managers put it down to laziness, while workers complained of physical exhaustion.

These views are borne out by the statistics available on the average weight of the spinners in comparison with the average weight of a prisoner in the same region. The average weight of a spinner not only was inferior to that of his British counterpart, but also lower than an average prisoner from the same region. The average spinner had a worse physical condition in all regions except in Madras and in Punjab. (Table 4)

The health and nutritional level of Bombay mill workers continued to remain a subject of concern in the 1920s. In his survey of cotton mills in India, Pearse found evidence of poor health caused by bad housing, poor diet. There was also a correlation between prevalence of malaria and the proximity of mills. One indicator of the poor health in overcrowded housing was the high incidence of infant mortality in housing of one room. 83% of the infant deaths took place in the single roomed dwellings in 1926.[27] The absence of workers over the age of 45 in the textile mill in the 1920s can reflect early retirement of workers on account of ill health.[28] There appears to be little ambiguity in the evidence that the average mill worker was not in good health, especially in comparison to workers in Lancashire. It would be surprising if poor health of the spinners did not result in lower effort.

[26] ITJ
[27] Pearse, p79
[28] Chandavarkar, p110.

TABLE 4: WEIGHT COMPARISONS: SPINNERS AND PRISONERS (AV WEIGHT IN LBS)

	SPINNERS	PRISONERS
BOMBAY	102.09	112.12
UNITED PROVINCES	107.01	115.08*
BENGAL	107.93	115.08*
PUNJAB	113.8	115.08*
MADRAS	113.63	113.38
BURMA	117.14	125.7
CENTRAL PROVINCE & BERAR	100.92	110.45
EASTERN BENGAL & ASSAM	108	110.85

Note: * Most of the spinners had migrated from the United Provinces.
Source: Indian Textile Journal, 1908.

Literacy

Clark's second same claim was that literacy was not a requirement for the jobs on the shop floor. Literacy among textile labour in the United States was low. The average British spinner operating the mule was more literate. Countries in the Western Hemisphere as well as Japan had higher levels of literacy relative to the Indian industrial workers. The high education level of the Japanese worker has been described by Pearse

as comparable to European standards and significantly different from the cotton mill workers in India, China and South America. The technical staff in Japan was well trained. Indian cotton mills showed a different picture.

In their comparative study of cotton mills in India and Japan, Otsuka et al argue that illiteracy can be a handicap in understanding the usage of machine and learning by doing and therefore have adverse effects on productivity. The authors quote from the Whitley Commission:

"It is impossible to overestimate the consequences of this disability, which are obvious in wages, in health, in productivity, in organization…. Modern machine industry depends on a peculiar degree of education and the attempts to build it up with an illiterate body of workers must be difficult and perilous."

Saxonhouse finds a strong positive effect on productivity of primary education of cotton mills workers in Japan during 1891 to 1935 and a weaker effect of technical training of the managerial staff. The study also finds a negative effect of hours of work. [29]

Factory Discipline

I now turn to factory discipline. In his well paper on work after industrial Revolution E. P. Thomson argued that even if education was not a requirement to perform monotonous tasks, having some level of schooling, in particular the experience of discipline at school was useful in adjusting to factory discipline. [30] British industrial workers' transition from the world of proto-industry to the shop floor followed years of difficulties with enforcing discipline. The change in length of a working day and effort at home was a result of battle with a stringent system of penalties. Thompson documents how new labour habits were formed in Britain after the industrial revolution. Much of

[29] Saxonhouse, 1977.
[30] Thompson, p84.

what was said about the English worker in the18th and 19th centuries was true the Bombay cotton mill worker in the 20th century. In his words:

"It sometimes took generation (as in the potteries)…. Irregular labour rhythms were perpetuated (and even institutionalized) into the present century."[31]

Discipline increased effort by 33% in Britain in the course the 19th Century.[32]For the first generation worker in cotton mills in Bombay cotton mills or in other Indian towns, this was a transition from the world of free labour working at his/her own pace in the environment of the family and open space of the rural community. Most workers in Bombay had close ties with the village. Some went back to the village during harvest, others to attend festivals and social occasions, such as weddings and even at times left the city due to ill health. Most adult male workers came to live in the city while their families stayed back in the village.

The factory compound was where a typical Bombay worker spent most of his time. The worker typically arrived earlier than the starting time, took many breaks during the working hours to smoke a cigarette or to drink tea. The factory compound was also the place where the worker bathed, washed clothes, ate his meals and took naps. On average a mill hand was said to pass 10-15% of his working day outside the mill building. A commentator wrote in the pages of the Indian Textile Journal: *"The Indian mill to the worker is their home."*[33] and a few months later: *"It is bad for a human being to stay long hours in the atmosphere of a factory, but the chawls*[34] *have much worse conditions with overcrowding, poor sanitary conditions and lack of light."* [35]

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[31] Thompson, p90
[32] Clark
[33] ITJ (Feb 1905)
[34] The living quarters
[35] ITJ (October 1905)

Comparisons were made with the dockworker in Bombay who had a heavier physical workload, but compared well with his British counterpart. The dockworker worked in an open environment, his training as an agricultural labourer had some use in the new job. The factory was the alien environment for a worker moving from the rural area to the city and the work was different from most skills learnt in the past. The discipline of a factory system was new to the first generation industrial worker who had no real *industrial education*. The mill hand did not require the strength of a dockworkers, but constant alertness. The mill worker's day stretched to 14 and a half hours. Temperatures were higher than in British factories and twice as many people packed in the same space.[36] In 1902, 32 out of 79 mills in Bombay worked these long hours.[37]

The condition within the factory building did not allow easy adaptation to the new place of work. The textile factory in Bombay was modelled on the style of an old Lancashire mill, but did not suit the local climatic conditions[38]. The place was overheated, badly lit and badly ventilated A retired mill manager argued- "It is curious to observe that whilst the Bombay mill owner is very anxious to have the latest and the best machinery, he continues to repeat peculiarities in his buildings that are obsolete in England."[39]Repeated absence to drink water was seen as a remedy for badly ventilated hot conditions,[40]

Much was written in the pages of the Indian textile journal about the habits of the Bombay textile mill hand and the conditions where he worked. It was claimed that the

[36] ITJ (Jan 1902)
[37] ITJ.
[38] Buchanan, p204-5.
[39] ITJ, April 1906
[40] ITJ, July 1893

stamina level of the mill worker had declined by 30-50% over a period of time.[41] The view that effort level a Bombay worker could not be compared with that of a British worker due to differences in physical condition and working environment. was expressed frequently.

The image of the factory worker in Indian industry was a contrast to the skilled textile workers of the earlier centuries. In his survey of cotton mills in 1929 Arno Pearse wrote:

"Indians as a rule and workers in Bombay in particular, do not possess the constitution which would be necessary for uninterrupted work under factory conditions of the ordinary type, in a climate such as it is in India during most parts of the year."[42]

Pearse's comment that one worked in the environment of his home, the other in factory conditions, reveals the problems of transition.

The industry had a rapid turnover of workers. In early years of the 20th century, some mills changed their entire workforce every 18 months. 20% of the workers in Bombay were permanent mill workers. The figure was higher outside Bombay. The average tenure a worker in a factory was 6-8 months.[43] Referring to the high turnover of the mill worker, Pearse wrote:

"No wonder that the Indian, particularly the Indian mill worker is an incompetent fellow. His constitution is frail, he does not get the food which is most suitable for him, he lives according to all information received an unwise life, he has no schooling, no ambition, is careless in the extreme." [44]

Table 5 shows the turnover rate of the Bombay workers. This figure is not very different from the figure of 6 months for the Japanese industry at the turn of the century.

[41] ITJ 1902
[42] Pearse, 1930.
[43] Pearse 1930, p6.
[44] Ibid.

Nevertheless, Japan achieved productivity gains. It appears that the claim that turnover could be an important factor in determining productivity was exaggerated.

The differences in factory discipline were more significant. Absenteeism was common in the Bombay mills. On an average day 10-15 % of the workers were absent during the first decade of the 20th century. Absenteeism was lower among male workers on piece rate in Bombay, in particular among weavers, who were on piece rate. There was a fall in absenteeism in the course of the 1920s.[45]

TABLE 5: LABOUR TURNOVER IN BOMBAY IN THE 1920S

Period of service(years)	No. of mills served						
	1	2	3	4	5+	Total	% of total workers
<5	341	104	41	14	6	506	37.5
5-10	132	82	47	39	15	315	23.4
10-15	58	53	47	23	33	214	15.9
15-20	42	18	18	14	30	123	9.1
20-25	31	18	9	12	17	87	6.5
25-30	18	6	5	4	13	46	3.4
30-35	10	3	3	1	7	25	1.9
35-40	5	5	5	1	2	15	1.1
40-45	4	2	2	0	2	9	0.7
>45	2	3	3	2	1	8	0.6

Source: Pearse, 1930, p74.

It is likely that the estimates of absenteeism were not very accurate as there were no proper records of leave granted suggesting an overestimate. Mills did not update lists

[45] Bombay Labour Office, Wage Census, 1921, 1926

of workers who had moved nor did they make no distinction between authorised and unauthorised leave. Some workers reported absent had been laid off laid off.[46]

Seasonal migration for agricultural work was seen to be the cause of the rise in absenteeism from April to October. but evidence for this is weak. The same seasonal pattern could be found in the incidence of diseases and could also explain the seasonal pattern of absenteeism [47] Visits to the village were not always for work on the field although long absences from the city were common. Evidence from the Carnatic mill in Madras shows that in 1907, 264 workers left in November which was the harvesting season, but 397 left in May. The average for the year was 329 suggesting that work in the field was not the cause of absence.[48]

Comparison with Japan

The Japanese labour force was mainly female. Over 70% pf the cotton spinners were young women and among them the majority were unmarried and in the age group fourteen to twenty These workers were recruited from the rural areas through agents and their wages were paid directly to the families. Unlike in India, the recruiting agent had no role within the factory. Most workers lived in dormitories near the factory. Hunter argues that dormitories were crucial in the evolution of factory discipline. The control of the management extended not just during working hours, but for the whole day.[49]

Workers were paid by piece rate and remuneration depended on quality and quantity. The system of wage calculation was complex and lacked transparency.

[46] Morris , p95.
[47] Morris1965 , p97-99
[48] ITJ
[49] Hunter.2003.

Workers were rewarded for effort, but also penalises for indiscipline.[50] The average wage for men in India in 1923 was 59 cents and for women 25 cents and for Japanese men 74 cents and for women 50 cents.[51] However, the Japanese figures do not include subsidies paid for food and lodging, which were substantial, suggesting that wages were on average higher in Japan. Pearse's estimates the wages in Bombay to be 10-15% lower on average in the second half of 1920s.[52]

The living and working conditions were far superior for the Japanese worker. Pearse, in his survey commended the facilities provided in the dormitories. The mills provided facilities for sports and entertainment, as well as education. Japan, by the turn of the century, had good primary education. Japanese workers had better nutrition.[53] There was little unionization among the workers in Japan[54] Japanese women worked night shifts, whereas in India women and children were barred from night employment by the factory laws. Wolcott sees the presence of female workers and advantage in achieving productivity gains. Others such as Buchanan, Otsuka et al see Japan's superior performance as a result of superior management.

Managerial Failure?

Why did Indian factories fail to impose the required factory discipline? The industry adopted a system of labour using practices that suited the factor endowment and factor prices. The system worked well up to the First World War Having a large number of men per machine was an optimal choice given the constraints in the production process. Labour was cheap, but was used the work practices of home based production.

[50] Ibid.
[51] Buchanan, p228.
[52] Pearse, 1930 p10-11.
[53] Pearse, 1929 p99-101
[54] Ibid.

This did not create much concern as employers could hire and fire at will. Wages rose during the war in response to the increased demand. Higher wage s created the need for organizational changes and higher productivity. Demand conditions changed at the end of the war. India had lost the export market in China to Japan and had to turn to the home market. The response of majority of firms was to reduce the wage bill. It was when firms tried to cut wages that resistance erupted on the shop floor. What emerged as a solution in the course of the 1920s were proposals for rationalization- more effort for the same pay. The more efficient firms such as Sassoon were able to bring about organizational changes. These firms switched to produced finer varieties of cloth for the domestic market. Increase work effort on the shop floor by reward higher levels of effort. Fred Stones of Sassoon, in his evidence to the Textile Labour Enquiry Committee, claimed that the firm did not want to reduce wages, but reduce the wage bill, thereby emphasizing higher labour productivity.[55]

The Indian industry had failed to develop mechanisms for higher discipline on the work floor in an effort to increase work intensity. In the British factories in the 19th century with new technologies that required high capital cost, worker accepted higher levels of discipline in return for higher pay.[56] Indian firms in the 20th century that increased effort levels did so by paying higher wages. Increase in work intens ity had to be rewarded by higher wage. The wage differential rose between single and double siders and between weavers operating 2 looms and 4 looms and automatic weavers.

A survey conducted by the Bombay Labour Office in 1926 documented the penalties imposed on workers for the first ten months. Information on dismissals is not

[55] Chandavarkar , p349.
[56] Clark 1994.

available, but we do know how many workers were penalized. The table 6 is based on information collected from 45 mills. An overwhelming proportion of the fines for men and women were for negligence in work This referred to spoilt or damaged material- their value was deducted from the workers wage. Weavers in particular were subjected to large penalties. [57] Poor quality output appears to be the main concern in imposing fines. Breaches of work discipline were unimportant. Late arrival at work or taking time off during working hours were less serious offences compared to failing to produce the right quality product. Morris documents the evidence presented to the Factory Commissions and argues that although the formal system of rules was severe, regulation of behaviour workers was surprisingly lax. Workers drifted in at start of work and gradually drifted away as the light began to fade.[58]. Either supervisors were not concerned about work intensity or chose to ignore breaches of it. The latter could arise from the social relation between the worker and the jobber. This contrasts with the effort to increase discipline at workplace in Britain and in Japan. The evidence from British cotton mills in the early days shows the strict regulation of working hours and high large fines for late arrival.[59] The evidence from cotton mills in India suggests that the managers had less concern about factory discipline. Labour costs were a small proportion of total cost and with the vast majority of the operatives being paid piecework rates, wage costs were not affected significantly by discipline. Equipment costs were relatively high and the critical objective was to run the machines as long as possible. In other words, economic rationale encouraged wasteful use of labour.[60]

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[57] Pearse p 89-90
[58] Morris, p111-112.
[59] Clark 1994, Thompson 1967.
[60] Morris, p117.

TABLE 6: FINES FOR INDISCIPLINE OR INCOMPETENCE JAN-OCT 1926

CAUSES FOR FINES	NO. OF INSTANCES	% SHARE
BREACH OF DISCIPLINE	21158	6
BAD OR NEGLIGENT WORK	30296	87
DAMAGE TO EMPLOYER'S PROPERTY	12881	4
OTHERS	9771	3
TOTAL	344106	100

Source: Pearse 1930, p89

Machines were run non-stop during the day. Regular lunch breaks were unknown mostly. Workers were allowed to stroll away from place of work to have their meals at any time. The employers responded to workers taking frequent breaks by employing more workers who were treated as reserve labour, meant to step in when needed. The Bombay Millowners Association opposed recommendations to introduce regular lunch breaks. The low wages provided a reason for over manning rather than imposing greater discipline. The process of hiring in the Indian mills could have made imposition of such discipline more difficult. The demand for casual labour was constantly changing not due to absenteeism, but the quality of cotton used, type of output produced. The labour market was well suited to the product market with many workers employed on a daily

basis. One survey estimated that for every worker employed in a month, two casual workers were available in the 1930s.[61]

Unions and Labour use

One way to analyze the importance of unionization in preventing organizational change would be to study the changes in labour use per machine in India and to assess if Bombay had a higher use of labour per machine as labour was better organized and more militant in Bombay relative to other regions in India.

I estimate the labour requirement of machines in 1889, 1910 and 1929. The data consists of firm-level information from all textile producing regions on labour employed and total equipment disaggregated into mules, rings and looms. I find that labour use increased from 1910 to 1929. However, the effect of a dummy variable for the Bombay mills turn out to be negative and statistically significant suggesting that labour intensity in Bombay compared to other regions was not higher. In other words the workers in Bombay were no less efficient that the mill worker elsewhere. Labour use per machine in Bombay was much lower compared to other reasons. (See table 7) This result is striking. It contests the hypothesis that workers resistance to increasing effort was the main cause of over manning. Clearly in other regions of India where the workers were less militant, labour-machine ratio was higher. We must therefore look for a different explanation of labour inefficiency in Indian mills.

[61] Chandavarkar, p296.

TABLE 7: LABOUR USE IN INDIAN INDUSTRY

REGRESSION RESULTS, DEPENDENT VARIABLE: DAILY LABOUR USE

	NO OF FIRMS	LABOUR USE PER MULE	LABOUR USE PER RING	LABOUR USE PER LOOM	EFFECT OF BOMBAY
1889	111	0.03*		0.82	**INSIGNIFICANT**
1910	225	0.01	0.02	0.53	**INSIGNIFICANT**
1929	320	0.02	0.03	0.73	**NEGATIVE AND SIGNIFICANT**

Note: *Total spindles.

Source: Reports of Bombay Millowners Association.

Wage Differential and Productivity

We do not have systematic evidence to make comparisons of productivity and the related pay. However there is evidence on pay differentials which indicate that the cotton mills did reward more efficient workers. The industry in Bombay had a wide differential in wages among the same category of workers. This was noted as early as 1893. The wages were not uniformly higher or lower in some mills. Some category of workers could earn more in a mill, but others less compared to the industry average. The tasks could have been different explaining part of the differential. However, the differential increased over time suggesting that higher pay could have been a reward for higher effort. The maximum difference before 1920 was about 30% between high and low wages. This figure had risen to at least 33% for one side ring spinners and 34% for 2

loom weavers in 1926 and 87% for grey winder and 73% for reelers. The corresponding figures were even higher in 1933: 46%, 90%, 63% and 175%.[62] The weavers, winders and reelers were on piece rates and the widening pay differences reflect differences in effort. The ring siders were on time rates and their wage differential may reflect rewards from employees to better workers. [63]

The BMOA claimed in 1929 that wages differed according to localities and the going wage rate in the neighbouring mill. Bombay Labour Offices data for 1933 grouping mills by district show the persistence of wage differential among different categories of workers within the district among both piece and time workers. [64]

More efficient mills did not reduce wages and were already paying the typical spinner (one sider) and the weaver (2 sider) wages that were higher than the industry average. On the other hand mills that cut wages paid wages below the industry average.[65] This suggests mills that were unwilling to pay more tended to be inefficient.

Workers tended to compete for jobs mills that had better pay and better working conditions. In mills that had poor quality machines jobbers had to attract workers by lending them money or standing as a guarantor for the moneylender. [66] The more efficient .mills also attracted to more efficient workers by offering them higher wages. Competition for more efficient workers bid up wages. As wages of some workers increased the neighbouring mills saw a demand for wage increases. However, the wide disparities in wages in the same neighbourhood continue to remain probably reflecting the productivity wage trade off.

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[62] Bombay Labour Office, wages and Employment, 1934.
[63] Morri, p157-158
[64] Morris, p 160
[65] Bombay Labour Office, wages and Employment, 1934.
[66] Chandavarkar, .p301-2.

The widely varying wage structure in the industry reflects large differences in productivity. Some mills had better machinery, better workers. But also the type of output produced determined productivity levels. In mills that achieved productivity gains higher workload and finer varieties of output went hand in hand, e.g. Sassoon, Bombay Dyeing, Finlay, and Kohinoor.[67] Mills producing finer quality cloth tended to pay their workers higher wages. Jobs, were highly differentiated- part of the labour using technology. However in instances where two jobs were combined as in Tata's Swadeshi mills, the worker was paid more- efficiency-wage trade off. [68] Weavers generally more earned higher wages than spinners. Spinners had to be paid more to train as weavers.[69]

Between 1926 and 1933, the earning differential between the weaver and the spinners narrowed. While earnings of two loom weavers declined, a spinner minding two sides of the frame and spinning finer counts of yarn were paid higher wages. (See table 8) Workers who were willing to undertake higher workload were paid more and favoured when chances of promotion appeared.[70]

TABLE 7: WAGE- EFFORT TRADE OFF IN THE BOMBAY MILLS

OCCUPATION	NUMBER OF WEAVERS	AV. DAILY WAGE (Rs- A- P)	WAGE DIFFERENCE
2LOOM WEAVER	24623	1-6-1	100
4LOOM WEAVER	3384	2-1-1	150
AUTOMATIC LOOM WEAVER*	34	2-8-1	182

Note: *Most weavers were paid by piece rates. This was a time rate.

[67] Chandavarkar, p351.
[68] Chandavarkar p317
[69] Chandavarkar, p320.
[70] Chandavarkar, p323

Source: Chandavarkar, 1994,

A Model of Wage-Effort Trade-off

Let us consider a simple model of the determination of effort and wages. Let *e* denote effort, and let us measure effort so that one unit of effort results in one unit of output. Let *p* denote the price of output, let *k* denote the capital requirement per worker, and *r* the interest rate. Let *w* denote the wage per unit of effort, so that the profits of the firm can be written as

p= *ep-w-rk*

Turning to the worker, let us assume that the utility of the worker, *U*, increases with the wage, but decreases with the disutility of effort, and can be written as

$U(w,e) = w - d(e)$

Where the disutility of effort, *d(e)*, is increasing and convex, so that the marginal disutility rises at higher levels of effort.

Fig. 1 graphs the typical indifference curve of the worker IC, corresponding to a given utility level. Let us now consider what effort choice would be a *Pareto efficient* arrangement, given the preferences of the worker and the production technology. To do this, we can graph the iso-profit curves of the firm. These are straight lines with slope *p*. An efficient arrangement corresponds to a point of tangency between the worker's indifference curve and the iso-profit curve IP. Thus e^* is the efficient choice of effort in this context.

There are of course many Pareto efficient arrangements, which can be ordered in terms of the extent to which they favour one party, say the worker. Thus some Pareto efficient arrangements give the worker higher wages and higher utility and the firm lower

profits than the others. However, we can see, in all Pareto-efficient arrangements, the effort level is the same, and equals e^*, and variations in worker utility are achieved entirely through the wage. Thus, even if the worker has some bargaining power, and gets a higher utility level than in a competitive labour market, an efficient bargain would imply that this increased utility is achieved not via reduced effort but solely through a higher wage.

Let us now suppose that existing effort arrangements are inefficiently low, and are at a level e' that is less than e^*. This is indicated in Fig. 2. Since this is Pareto inefficient, there is a way to make both the worker and the firm better off. This involves an increase in worker effort towards e^*, where the worker is compensated for this by an increase in the wage.

There are two possible explanations for the low effort levels of the worker in the Indian cotton mills. The first explanation, advanced by Clark and Walcott, is that low effort reflected worker preferences, so that arrangements were in fact Pareto efficient. That is the, actual effort choices were in fact close to e^*, so that it did not make economic sense to increase effort. The alternative explanation is that actual arrangements were Pareto-inefficient; so that both workers and firms could have been made better off by wage-productivity agreements, where the worker agreed to raise work effort in exchange for higher wages. For this latter explanation to make sense, one has to come up with a reason why the two parties failed to make a Pareto-improving trade.

This failure is could be a failure of initiative, possibly based on a lack of information. For the two parties to make such an improvement, one of them has to know that there is the potential for mutual gain, and has to *initiate* the improvement. One

cannot expect the worker, who was illiterate and with limited knowledge of the profit opportunities of the firm, to appreciate the possibilities of such a Pareto-improvement. So why did the entrepreneur fail to appreciate this possibility of mutual gain?

An Explanation of entrepreneurial failure

A plausible reason for the failure of entrepreneurship is the structure of management in the Indian cotton textile industry. The technical staff, who were mainly European and had knowledge of work norms in England, were the best placed to know of the *potentiality and benefits* of increasing work effort profitably. These were separated socially from the jobbers who were in charge of worker discipline and recruitment, who would have best knowledge of worker preferences. Since making a Pareto improvement relies on combining the information from these two sources, one explanation is that the social distance between these resulted in a failure of communication.

An additional reason may be due to the incentives of the managing agents, who ultimately held overall responsibility for the organization. Right up to the turn of the 20th century, the managing agents' returns depended upon the *output* of the firm rather than profits. Thus they had relatively weak incentives to engage in cost reductions. Even when mills switched to commission on profits, the relevant category was total profits and not profits net of depreciation.

A second explanation for the persistence of inefficiency is that the entrepreneurs did initiate such wage-productivity agreements, but these were resisted by the workers. Such a move could be initiated by trade unions, which may have different preferences from those of the individual worker. It could be argued that the power of union officials depended upon the size of the workforce. An agreement to raise worker effort would

result in a reduction in manning levels, and thus the size of the workforce, and would therefore be resisted by unions. Thus unions would oppose wage-productivity agreements, even though these would be in the interest of individual workers who continued to be employed. This argument is in line with Clark and Wolcott, who argue that unions were a force for resisting productivity improvements. However, it is clear that the low effort regime was in force long before trade unions gained prominence in Bombay. Furthermore, our empirical results show that productivity gains were larger in Bombay as compared to the peripheral regions where unionization was not a problem for employers. Faced with declining profits, the employers tried to reduce wages and it is hardly surprising that the workers resisted it.

The Tariff Board in 1927 recognized that the only alternative to reduction in wages in increased efficiency. The Mill owners responded that such a structural change was a risky option without a protected domestic market. Committees set up to look into to the plight of the Bombay cotton textile industry recommended measure for a more efficient management of the labour force. The cotton mill managers had a clear cut option- reward increased effort for the permanent staff. Having a large body of casual workers in the industry made rationalization an easier option as permanent workers did not have to be laid off. Instead the Bombay mill owners were concerned with keeping wages low. Where effort was rewarded with increased pay, workers did change their effort level as table 7 shows. But the proportion of such workers remained low. . Only 10,000 workers were affected by the efficiency schemes.[71]

[71] Chandavarkar, p275-276.

Wages and labour productivity in cotton mills: An alternative view

Let me turn back to Clark's argument that labour productivity in cotton mills explain why some economies are more developed than others. Work effort and labour productivity in cotton textiles differed significantly across countries, as did wages in the industry. Clark interprets this positive correlation between the two variables as the former causing the latter, t hat is, high productivity in cotton textiles made for high wages, while countries where cotton textile workers were less productive had lower wages. This view is inconsistent with a competitive labour market. Cotton textile workers were only a small fraction of the total workforce in all these countries. For example, in India, the entire industrial workforce was less than 10% of the total labour force. Thus the wages of cotton textile workers would not be determined by the level of productivity in cotton textiles, but by the general level of wages in the economy as a whole. If textile workers were substantially more productive, this would mainly be reflected in higher profits, with only small effects upon wages. Thus, high cotton textile wages in the USA or UK (and later in Japan) reflected high wages in the economy.

Support for this view comes from the fact that GDP per capita in Japan over 35 percent higher than India's per capita GDP in 1870, and the fact that living standards in the two countries diverged subsequently. By 1900, Japan had nearly twice the per capita income of India, and by 1925 it had 2.7 times as much.[72] Per capita GDP grew by .54% per year in India during 1870-1913, a striking contrast to Japan's growth rate of 1.48% per year. The corresponding growth rates in India and Japan during 1913-1950 were -0.22% and 0.89% respectively. Only 50% were employment in agriculture in Japan in 1870 and 24% in industry. The share of agriculture in employment had fallen to 27.5% in

[72] Maddison, 2001.

1913. The share of industry was nearly 30%. [73]In India only 10.6% of employment was in the secondary sector in 1901 and 75% in primary sector. The share of the secondary sector had fallen to 9% in 1931.[74]

These movements in per capita income were mirrored in wage trends in the cotton mills. In Japanese cotton mills, money wages increased four times between 1903-07 and 1918-22. In Indian cotton mills, the wages doubled during the same period. Changes in real wages show similar differences. This supports our claim that trends in cotton mills were mainly driven by trends in general wages and per capita incomes. These differences in wages between countries resulted in differences in labour productivity in cotton textiles. The industry in high wage countries could only survive if the workers were more productive. Thus Japanese entrepreneurs faced pressure to innovate and raise labour productivity, while Indian entrepreneurs did not.

This pushed entrepreneurs in Japan to bring about changes in labour use. In India, the relative price of capital goods increased, making capital the main constraint. Labour was the cheap input. In Japan the relative price of capital goods declined continuously relative to wages creating a momentum for changes in technology. It seems likely that wage increases did not follow increases in productivity. It is the faster economic growth in Japan that increased wages in the economy and pushed firms towards increasing productivity. In India these pressures were less important. The overall economic development was sluggish. Wage driven productivity growth did not become necessary until the 1920s.

[73] Maddison, 2000
[74] Shivasubramoniam, p33.

YEARS	JAPAN			INDIA (BOMBAY)		
	CAPITAL GOODS PRICE INDEX	MONEY WAGE INDEX FOR COTTON SPINNERS	RELATIVE PRICE CHANGE	TEXTILE MACHINERY PRICE INDEX	MONEY WAGE INDEX IN COTTON MILLS	RELATIVE PRICE CHANGE
1903-07	**100.00**	**100.00**	1.00	**100.00**	**100.00**	1.00
1908-12	**103.67**	**125.58**	083	**106.19**	**112.54**	0.94
1913-17	**131.82**	**148.84**	0.89	**196.34**	**130.71**	1.50
1918-22	**258.74**	**429.77**	0.60	**336.60**	**219.52**	1.53
1923-27	**231.99**	**525.12**	0.44	**242.09**	**258.26**	0.94
1928-32	**174.83**	**465.12**	0.38	**204.86**	**265.19**	0.77

TABLE 9: CHANGES IN WAGES AND COST OF CAPITAL: INDIA, JAPAN

Source: For Japan- Otsuka et al. table 5.1, p68
For India- Bagchi, p122

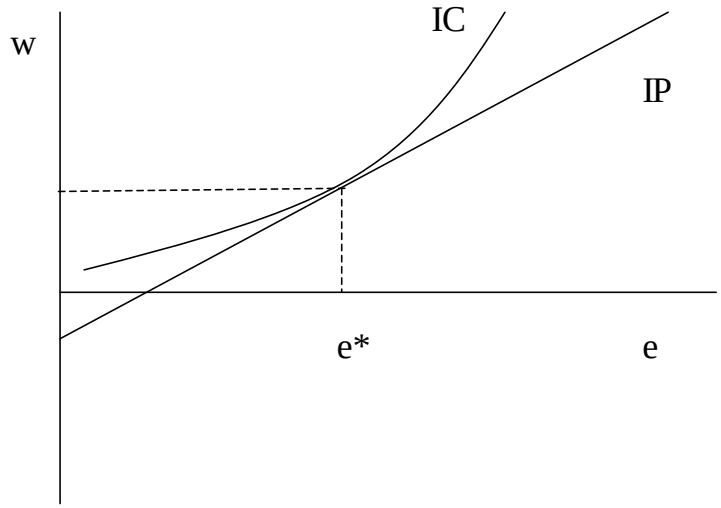

Fig. 1

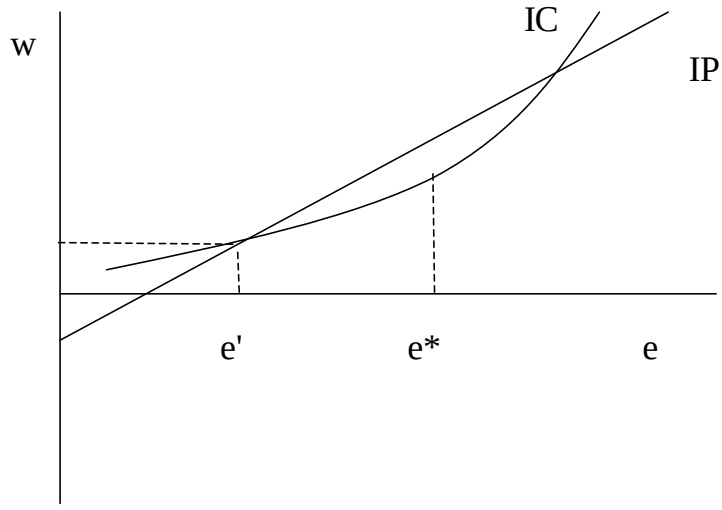

Fig. 2

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