

**PARTICIPATION AND THE EFFECT OF NEW TECHNOLOGY  
UPON WORK:**

**The Case of Small- and Medium-scale Manufacturing Firms in Tokyo\***

*Akihiro ISHIKAWA\*\**

**INTRODUCTION**

In Japanese industry there have been, and still are, remarkable differences between large-scale firms and small- and medium-scale firms in terms of the standard of wages and working conditions as well as in terms of productivity and technological level. However, nowadays, it is noticeable that the new microelectronic technology is being widely introduced in small- and medium-scale firms simultaneously with the large-scale firms, and is having certain effects on them. This is conspicuously different from the technological innovations which took place around the end of the 1950s and the beginning of 1960s. In the latter case, new technology was introduced first in the largest firms of heavy manufacturing industry, and there was a time lag before it reached medium-scale firms.

The reasons why new technology is at present spreading to medium-scale and even small-scale firms are varied. From the technological viewpoint, microelectronics has a wide scope of flexible application in industry; it does not require a mass-production system but can be used for small scale production. Then, from the economic view point, it does not require large-scale capital investment, and microelectronic hardware is relatively cheap in price, so that small-scale firms can buy it without much difficulty. Further, from the viewpoint of the labour market, small- and medium-scale firms today suffer from a shortage of skilled workers and an increase in personnel costs, so that they are tending to introduce automating machines to substitute for and reduce the workforce.

Though many of the small- and medium-scale firms which have introduced automating machines have aimed to reduce the workforce, redundancy is a very rare event among them. A survey conducted in Kawasaki City, an industrial district neighbouring Tokyo, shows

---

\* Paper for the Capitalist-Socialist Workshop on Organizational Behaviour, Helsinki, 29—31 August, 1984.

\*\* Faculty of Letters, Chuo University, Tokyo.

that more than 70% of the plants surveyed have retrained workers in some way to keep them in the same work-place, and 24% of the plants have not made any changes in workforce allocation, particularly small- and medium-scale ones. In other cases employees have been transferred to different workplaces within the same plant or the firm, but redundancy was found in only 5% of the plants surveyed.<sup>1</sup> Similar examples can be seen in the results of other surveys concerning new technology.<sup>2</sup>

In the case of large-scale firms, when a surplus of labour occurs due to automation in the plant, surplus staff are transferred to other sections within the plant or the firm to avoid redundancy, and the existing workforce is retrained by means of on-the-job or off-the-job training. If the organizational size of the plant or the firm is large enough, transference of workforce within it may be possible. However, small- and medium-scale firms are not able to move the workforce from one place to another so easily because of limitations of organizational size and capacity. Therefore, to avoid redundancy, they have to keep the existing workforce in the same workplace, even when automating equipment is to be introduced there. In this case the content and character of their job has necessarily to be transformed to adapt to the newly introduced equipment and technology.

The purpose of this paper is, then, to observe what kind of changes occur in the content and character of jobs at the plants of small- and medium-scale firms in manufacturing industry, and to examine whether there are due to these changes significant differences between the workplace where workers participate in decisions and the workplace where the workers' voice is not heard.

### CHANGES IN THE JOB

Surveys on workers' attitudes to the introduction of new technology reveal commonly that the majority of attitudes are positive. According to the survey conducted in Kawasaki City cited before, managers of more than half the plants surveyed answered that their employees willingly accepted new technology and automating equipment, while managers of less than 10% of the plants surveyed reported negative or critical attitudes among their workers to the introduction of new technology.<sup>3</sup> Similar results have been obtained from other surveys conducted by different local or regional governments and labour unions.<sup>4</sup> The Kawasaki City Government sent the question-

<sup>1</sup> Data are displayed in *Kawasaki City White Paper on Labour*, Kawasaki City Government, 1983.

<sup>2</sup> For example, *Survey Report on the Introduction of ME-applied Machines*, Aichi Prefecture Government, 1982.

<sup>3</sup> *Op. Cit.*, Kawasaki City Government.

<sup>4</sup> For example, *Survey Report on ME-controlled Industrial Machines and Employment*, Kyoto-fu Institute of Labour and Economy, 1982; *Survey Report on the Effect of Industrial Robots upon Employment*, Hyogo-ken Institute of Labour and Economy, 1983; *Survey Report on the Effect of Mechatronics Production Machinery and Office Automation Equipment upon Employment*, Japanese Metal Industrial Workers' Union, 1982.

naire not only to managers but also to ordinary workers and obtained the same result as from managers: less than 10% of workers were negative or critical and around half of the respondents showed positive attitudes to the introduction of automating machines into their workplace. The same survey showed that 80% of the responding workers answered that the new technology had had favourable effects on their workplace, while negative answers were negligible.<sup>5</sup> Such a trend in workers' views is also verified by the survey conducted by the National Federation of Small Businesses Association in 1983.<sup>6</sup> This survey restricted its sample to small- and medium-scale firms, and showed that nearly half of the employees were positive and active in promoting automation, while about a third of them were passive and about 10% were negative or indifferent.

As seen above, new technology and the trend to automation seem to be positively accepted by the majority of workers, and the kinds of changes taking place in their own jobs now has to be examined. Some survey results reveal the workers' perception of these changes as follows.

First, a survey in 1982 by the Japanese Federation of Electrical Machine Workers' Unions covering large- and medium-scale plants reported that: 1) the level of skill of the workers rose, 2) job scope enlarged, and 3) the responsibility of those workers who dealt with microelectronics rose higher than those who did not.<sup>7</sup> Another survey by a machine industry union illustrated that the complexity and range of work under technological innovation increased.<sup>8</sup> According to the perception of workers, the JFEMWU survey shows that over 60% of workers dealing with ME equipment perceive an increase in skill, enlargement of job range and increase in responsibility, while less than 5% perceive a decrease in skill, job range and responsibility.<sup>9</sup>

Second, with the enhancement in the level of skill, job range, responsibility and complexity of work, workers' morale and job satisfaction is increased, especially among younger workers. The survey in Kawasaki City reveals that more than 80% of the workers questioned have an interest in working with newly introduced automation, regarding it as helpful to their self-fulfillment at work.<sup>10</sup> According to a survey by the Labour Institute of the Tokyo Metropolitan Government in 1983, many of the managers of medium- and small-sale plants in the metal and machine industry foresee a positive development in employees' morale and motivation as an effect of the introduction of microelectronics,<sup>11</sup> as shown in Figure 1.

<sup>5</sup> *Op. Cit.*, Kawasaki City Government.

<sup>6</sup> *Studies in the Effect of introducing ME upon Employment in Small- and Medium- Scale Businesses*, National Federation of Small Businesses Association, 1984.

<sup>7</sup> *Survey Report on the Effect of ME Technology upon Employment and Work*, Japan Federation of Electrical Machine Workers' Unions, 1983.

<sup>8</sup> *Survey Report on Workers' Consciousness about Union Activities*, TOKIKO Trade Union, 1982.

<sup>9</sup> *Op. Cit.*, National Federation of Small Businesses Association.

<sup>10</sup> *Op. Cit.*, Kawasaki City Government.

<sup>11</sup> The survey result will be published by the Labour Institute of Tokyo Metropolitan Government at the end of 1984.

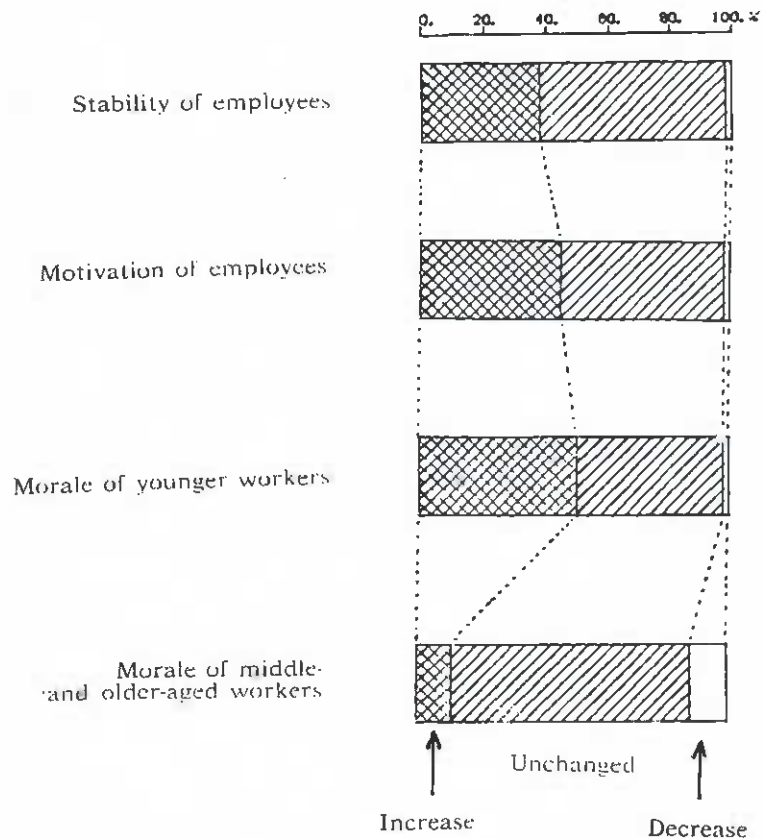


Figure 1 Forecast of managers on the effect of microelectronic machinery in small- and medium-scale plants

Third, parallel with the increase in morale and motivation, it should be noticed that the burden of work is also increased, which leads to an accumulation fatigue, especially mental fatigue. The survey by the National Federation of Small Businesses Association reveals that, among thirteen items illustrating the recent changes of work in automation, «mental or psychological fatigue» figures most frequently in the responses of workers of small- and medium-scale firms.<sup>12</sup> Further, the survey in Kawasaki City pointed out that by introducing highly automating machines 40% of the workers questioned felt anxious about the increase in mental burden and nearly 30% of them expected an increase in the obligatory amount of tasks as well as the intensity of work.<sup>13</sup> These survey results show that there are not a few workers who feel hardship in their work under the new technology.

Next, let us concentrate our attention on the changes in work among small- and medium-scale plant workers. The author and his research group carried out a survey on the perception of those workers in terms of the changes in their work under the new techno-

<sup>12</sup> *Op. Cit.*, National Federation of Small Businesses Association.

<sup>13</sup> *Op. Cit.*, Kawasaki City Government.

logy.<sup>14</sup> This research was conducted in Tokyo in 1983, collecting responses from 391 samples in manufacturing industry. In order to understand workers' perception, we prepared twenty items, requesting respondents to answer each item in terms of whether and how it had changed. The distribution of the answers is shown in Figure 2.

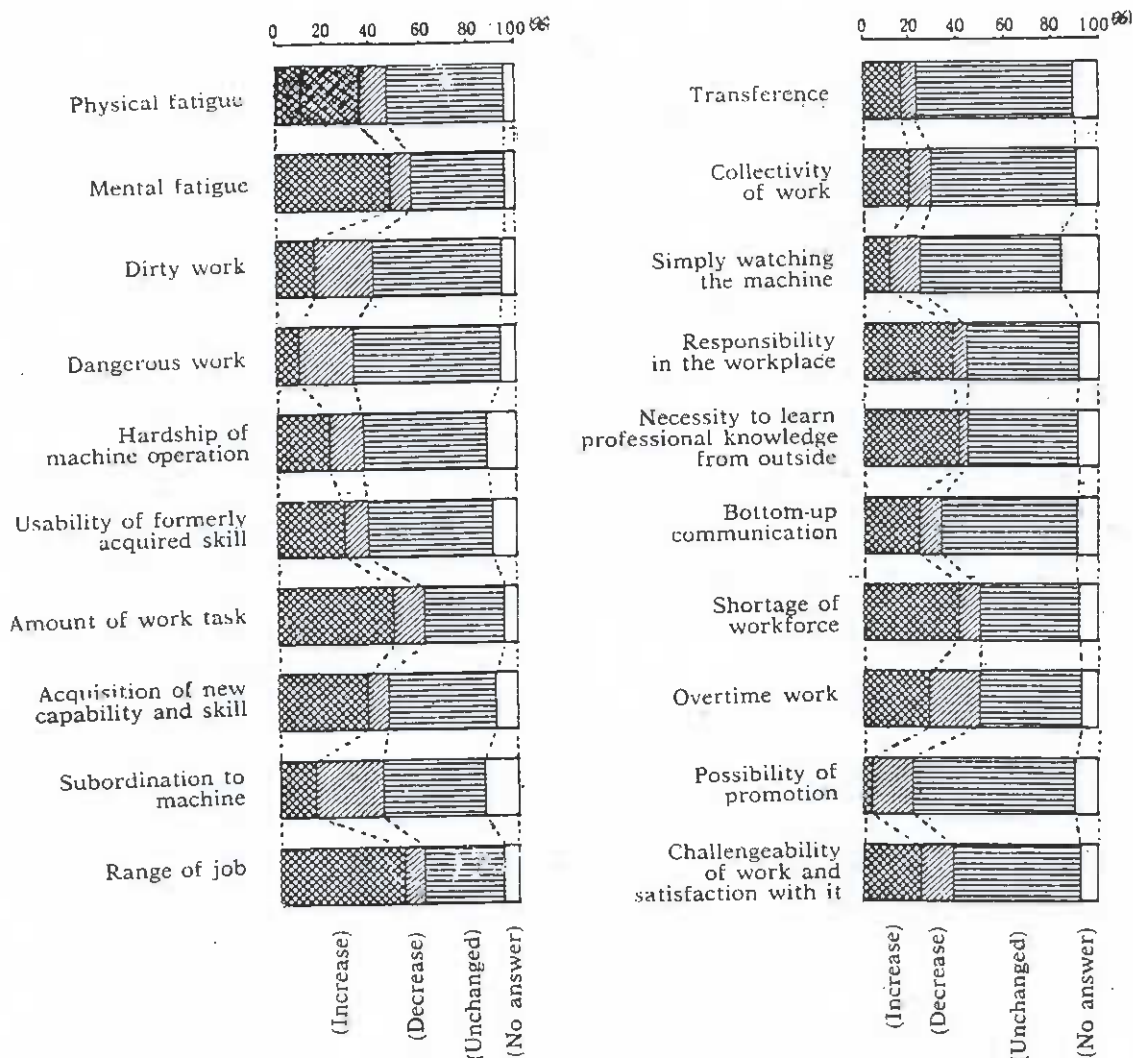


Figure 2 Perception of the change in work

By rearranging this data as shown in Table 1, we can summarize the research results as follows.

First, new technology does not seem to bring organizational and personnel changes in small- and medium-scale plants as much as in larger ones. Transference of workers very rarely occurs; promotion possibility is almost unchanged; and the form of work group is also nearly the same. These effects seem to come from the limited size of plant organization.

<sup>14</sup> This research has been conducted by Takashi Kawakita, Michiko Kondo, Mitsuhide Shiraki and myself. The final report will be published by the Labour Institute of Tokyo Metropolitan Government at the end of 1984.

Table 1 Changes of work and job

RESPONSE OF «UNCHANGED» < 50%	NEGATIVE RESPONSE	Over 30%	<ul style="list-style-type: none"> <li>● Aquirement of new capability and skill</li> <li>● Enlargement of job range</li> </ul>
		20—29%	
		10—19%	
		5—10%	
	POSITIVE RESPONSE	5—10%	● Hardship of machine operation
		10—19%	● Overtime work
		20—29%	
		Over 30%	<ul style="list-style-type: none"> <li>● Mental fatigue</li> <li>● Shortage of work force</li> <li>● Increase of the amount of work and task</li> </ul>
RESPONSE OF «UNCHANGED» ≥ 50%	NEGATIVE RESPONSE	Over 20%	<ul style="list-style-type: none"> <li>● Increase of responsibility</li> <li>● Necessity of obtaining knowledge from outside</li> </ul>
		10—19%	<ul style="list-style-type: none"> <li>● Usability of hitherto formed skill</li> <li>● Bottom-up communication</li> </ul>
		5—10%	● Challengeability of work
	POSITIVE RESPONSE		<ul style="list-style-type: none"> <li>● Dirty work</li> <li>● Subordinating feeling to machine</li> </ul>
		5—10%	
		10—19%	
Response of «unchanged» ≥ 70%		Over 20%	● Physical fatigue
			<ul style="list-style-type: none"> <li>● Possibility of promotion</li> <li>● Dangerous work</li> <li>● Transference</li> <li>● Collectivity of work</li> <li>● Work of only watching the machine</li> </ul>

Second, the relationship between machine and men/women is largely unchanged. Dangerous work has not increased; the job of just watching a machine has not increased either; the feeling of workers of being completely dependent on the machine neither much increases nor decreases, generally speaking.

Third, the range of job as well as the responsibility at the workplace is, however, enhanced, and in connection with this the necessity of obtaining new knowledge is greater.

Fourth, this change seems to lead to some favourable tendencies in terms of participation, morale and motivation. The number of workers who perceive that they have a greater say in management and an enhancement in the challenge of their work and job satis-

faction has to some extent increased. The workers who answered that they had recently acquired new capabilities and skills comprised a major part of the whole sample.

Fifth, on the other hand, the intensity of work and fatigue from work increased. More than a few workers point to an increase of difficulty in operating the equipment, and many workers especially stress the increase in the amount of work and at the same time the shortage of staff in their workplace. Overtime work is also increased in not a few cases.

In conclusion, new technology is likely to bring about a change in job scope and worker responsibility, which throw both light and the shadow upon the workers: some considerable increase in morale and motivation on the one side, and an increase in the burden of work as well as the accumulation of fatigue on the other. Let us therefore raise the following question: are there any differences in the above effects of new technology between the workplace with a participatory climate and that with a non-participatory one? If new technology is introduced in the participatory workplace, does the negative effect show itself there as much as in the non-participatory workplace?

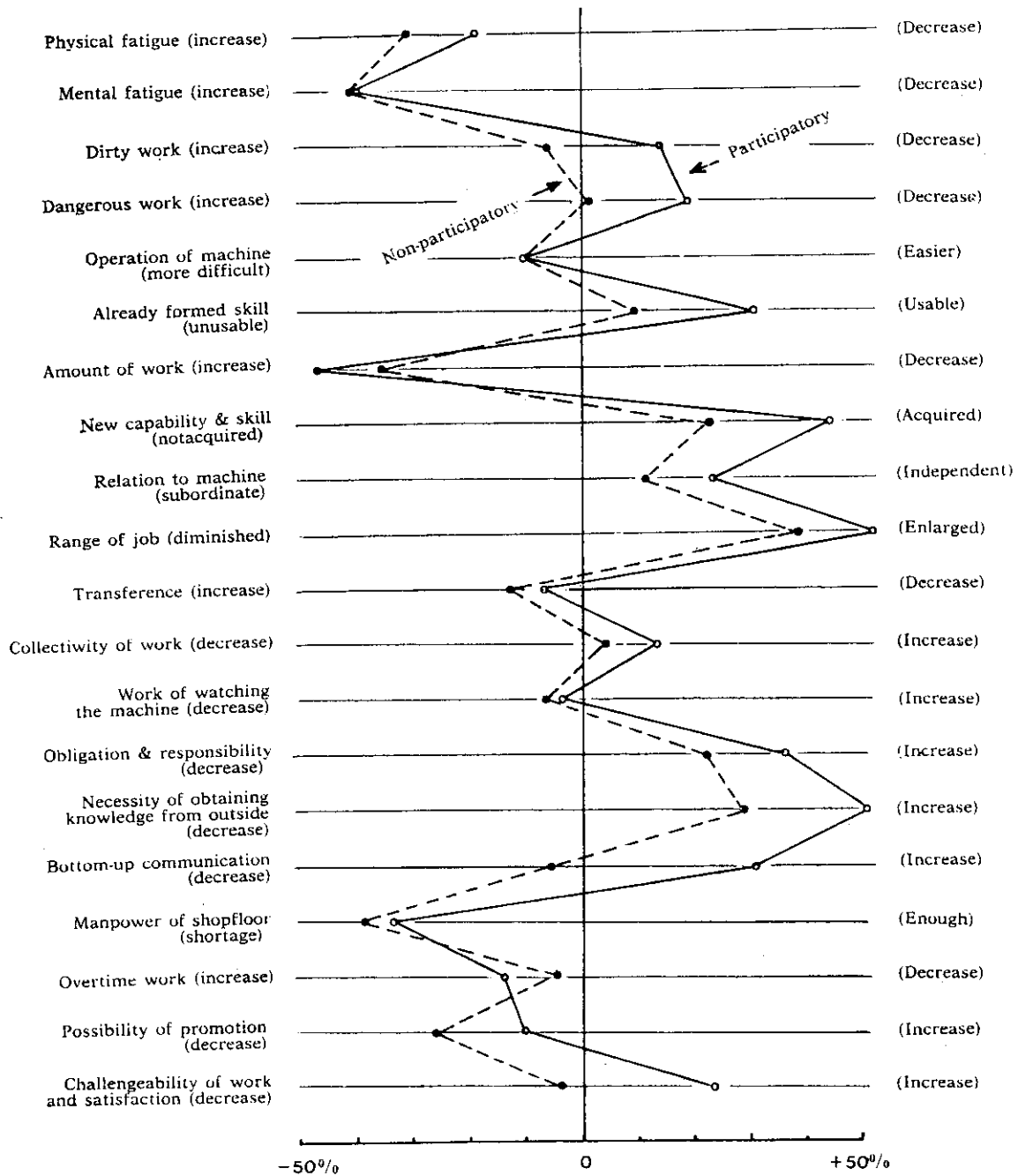
#### PARTICIPATION AND THE EFFECT OF NEW TECHNOLOGY

In our research referred to above, we divided the samples into two groups: workers who answered that their voices were usually or sometimes heard by management at the workplace, and workers who answered that they were not. Then we compared the perception of these two groups in terms of their answers to each item illustrating the change of work. Figure 3 shows the difference between the percentage of workers who gave a positive answer and that of workers giving a negative answer in a particular item. As seen in this table, there is a large difference in some items, while there is a negligible one in others.

By rearranging the data, we can point to the following facts:

- The difference is over 30% — 'bottom-up communication'.
- 20—30% — 'dirty work', 'usability of already formed skill', 'challengeability of work and satisfaction', 'necessity of obtaining new knowledge from outside' and 'increase in new capability and skill'.
- 10—20% — 'physical fatigue', 'range of job', 'responsibility and obligation', 'possibility of promotion', 'dangerous work', 'subordinating feeling to the machine'.
- Less than 10% or minus — 'mental fatigue', 'hardship of machine operation', 'amount of work', 'transference', 'team work or not', 'work of only watching the machine', 'shortage of workforce at the shopfloor', 'overtime work'.

From the above it follows that workers involved in a participatory climate at the workplace perceive an enlargement of job range, an increase in their responsibility at the workplace, a decrease in dirty and dangerous work, a growth of new capabilities and knowledge and of challengeability of work and job satisfaction compared to the



\* (% of positive answer) — (% of negative answer)

Figure 3 Difference of the change in work between a participatory and a nonparticipatory climate

workers in a non-participatory climate. A participatory climate at the workplace seems to contribute to the improvement of the working environment to some extent by the introduction of new technology, and to promote job enlargement, development of skill and ability, and enhancement of morale and job satisfaction.

On the other hand, a participatory climate does not eliminate or decrease the problem of the intensification of work and an increase in mental fatigue. New technology increases the amount of work,



overtime work, difficulty in machine operation and mental fatigue due to the shortage of workforce in more than a few workplaces, and this trait can be found both in a participatory climate and a non-participatory one. With regard to such problems, the participatory climate does not solve them so effectively. For solving them, other mechanisms might be required. Negotiation or consultation through the labour union or the employees' representatives would be one of them.

Concerning labour-management negotiation in introducing the new technology, one of the serious problems among small- and medium-scale firm workers is that the unionization rate is very low. The average rate of unionization among all employees in Japan today is around 30%, but among workers of firms with less than 700 employees it is below 10%. The second problem is that even in large- or medium-scale firms with a relatively high unionization rate, labour-management negotiations on the introduction of new technology cannot be found very frequently. According to a survey by the Japan Institute of Labour in 1983, the number of local unions which negotiated the introduction of new hardware is only slightly more than a half.<sup>15</sup> Further, surveys by several local governments in industrial districts, also covering small-scale firms and plants, reveal that joint consultation or negotiation on this specific issue has been held in only 30% or so of the plants surveyed, and that there is only a negligible difference in this percentage between unionized and non-unionized plants.<sup>16</sup> The survey by the National Federation of Small Businesses Association concentrating on the situation of small- and medium-scale firms shows the percentages of the firms where workers were allowed to participate at the introduction of microelectronics, as follows.<sup>17</sup>

- »Management has allowed workers to study how to introduce me« — 34.6%;
- »Management has listened to the voice of the workers« — 25.6%;
- »Management has explained to workers the workplace concerned« — 23.1%;
- »Labour-management consultation has been held« — 3.1%;
- »The issue has been treated in collective bargaining« — 0.3%;
- »No action for participation has been taken« — 10.1%.

Some federative organizations of unions are taking initiatives to set up a collective agreement with management to protect workers' interests in introducing the new technology,<sup>18</sup> but at a local level,

<sup>15</sup> *The Introduction of ME Machinery and the Reaction of Labour Unions*, Japan Institute of Labour, 1984.

<sup>16</sup> Besides the survey reports by Kawasaki City Government, Aichi Prefecture Government and Hyogo-ken Institute of Labour and Economy cited above, *Survey Report on the Effect of Highly Automating Machinery*, Kanagawa Prefecture Government, 1983; *Survey Report on the Introduction of Mechatronics Machinery and its Effects*, Shinagawa Labour Administration Office in Tokyo, 1983.

<sup>17</sup> *Op. Cit.*, National Federation of Small Businesses Association.

<sup>18</sup> For example, the instructions or guidelines prepared by the Japan Federation of Electrical Machine Workers' Unions, by the Japanese Metal Industrial Workers' Union, etc.

union leaders as well as ordinary union members are likely to hold such a view as: »The firm which does not introduce new technology cannot survive in the severely competitive national and international economic situation, which would result in unemployment.« This atmosphere is reflected by the attitude of union leaders at the local level who are increasingly willing to accept the introduction of new technology, as shown by a survey report from the Japan Institute of Labour comparing trends in 1981 and 1983.<sup>19</sup>

## CONCLUSION

Even with the introduction of the new technology and automating machines in order to reduce the workforce, Japanese management, not only in large-scale firms but also small- and medium-scale enterprises very rarely applies redundancy measures, maintaining the hitherto dominant style of employment practice. On the other hand the automating machine, by its nature, produces a surplus workforce at a given workplace. In the case of large-scale firms, the problem of surplus workforce may be solved through transference within the plant or firm, but small- and medium-scale enterprises do not have enough scope for transferring surplus workforce from one section to another.

In such a situation, management of small- and medium-scale enterprises is likely to use the existing workforce in the same workplace when new technology is introduced. The workers will then be re-trained, but the skills which workers acquired before are kept and utilized in the new technological environment. With the introduction of new technology, job scope has been enlarged and the responsibility of workers on the shopfloor enhanced. All of these tendencies lead to the development of the skills and abilities of workers. Parallel with this, workers have gained more interest in their work and are more satisfied with their jobs. Moreover, new technology helps to improve the working environment to some extent.

Such a general trend clearly appears among workers who work at a workplace with a participatory climate. Such a climate seems to promote it.

On the other hand, new technology brings about a intensification of work and an accumulation of fatigue, especially mental fatigue. This trend is found as much in the participatory workplace as in the non-participatory one. In other words, even if the climate is participatory, this problem cannot be easily solved. Labour unions might be expected to take action for tackling this problem, but in reality there is a very small rate of unionization among small- and medium-scale firm workers. Besides, consideration by union leaders and ordinary members on the survival of their firms in a serious competitive environment hinders the development of such a collective action.

---

<sup>19</sup> See the report of Japan Institute of Labour cited above, page. 12.

Thus, the spread and development of new technology is progressing among small- and medium-scale firms, accompanying the light and shadow depicted above.

Received: 24. 7. 1985.

Revised: 23. 9. 1985.

**PARTICIPACIJA I UTICAJ NOVE TEHNOLOGIJE NA RAD:  
SLUČAJ MALIH I SREDNJIH INDUSTRIJSKIH PREDUZEĆA  
U TOKIJU**

Akihiro ISHIKAWA

*Re z i m e*

Skorašnja istraživanja nove tehnologije u japanskoj industriji pokazuju da je nova tehnologija veoma retko prouzrokovala višak ili otpuštanje radne snage. U velikim preduzećima, kada uvođenje nove tehnologije uzrokuje višak radne snage, radnici se premeštaju na druga radna mesta i dati se nivo zaposlenosti održava. Međutim, u malim i srednjim preduzećima radna snaga treba da se zadrži na datim radnim mestima usled ograničenih organizacionih mogućnosti preduzeća. Stoga se može postaviti pitanje: šta se dešava na radnom mestu u malom ili srednjem preduzeću prilikom uvođenja nove tehnologije? U članku ovaj problem se tretira na osnovu rezultata istraživanja do kojih je došao autorov tim istraživača u Institutu rada gradske uprave Tokija 1983. godine.

Pomenuto istraživanje otkriva sledeće: radnici već stečenih kvalifikacija mogu opslužiti i novu tehnologiju; opseg poslova je proširen i povećana je odgovornost radnika; radnici su se u znatnoj meri oslobodili potčinjenosti mašini; smanjeni su opasni poslovi i povećano je zadovoljstvo radnika na radnom mestu. Sve se ovo može podvesti pod pozitivan uticaj nove tehnologije. Ali, postoji i njen negativan uticaj: povećan je kvantitet rada kao i zamor radnika usled nedostatka radne snage u radionici.

Navedeni uticaji nove tehnologije različito se ispoljavaju na participativnim i neparticipativnim radnim mestima. Na participativnom radnom mestu pozitivan uticaj je uočljiviji a negativan uticaj je ređi nego na neparticipativnom radnom mestu. Ovo, pak, znači da nova tehnologija nema jednoobrazan uticaj na rad nego da participacija može preobraziti taj uticaj u više ili manje povoljne uslove za radnike.