KAIZEN RESEARCH FOR SUSTAINABLE PRODUCTION FIELD CONSTRUCTION

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Abstract : In this research, KAIZEN research of the fusion of productivity and humanity was conducted in cooperation with both two smaller companies and outside research institutes in order to tide over “super-advanced age and fewer children” society and contribute to sustainable production field construction which is essential for the activation of the manufacturing industry in Hokkaido, the northern main island of Japan. As a result, the enlightenment activities by the outside researchers led to the employees’ own KAIZEN, and 16 items in construction machine attachment manufacturing and 10 in agricultural machinery manufacturing were embodied. Moreover, in both factories was successful the training of human resources who could actualize quality improvement, cost reduction quick completion & delivery of products and KAIZEN, and also the company climate for that training was fostered.

It is thought that KAIZEN corroboration in cooperation with smaller companies and outside research institutes plays a significant role in the activation of the manufacturing.

1. INTRODUCTION

Japan’s economy is now said to be in boom though most people can hardly feel that boom. On the other hand, the northern main island of Japan Hokkaido is still suffering from slow business though there are some signs of improvement thanks to private plan and equipment investment and opening of new factories of automobile-related companies. In this “super-advanced age, fewer children” society, the government has enforced laws of deferred annuities and continued employment (up to age 65). The manufacturing industry in this district needs to emerge from public works and local business and become competitive in the field of private under undertakings and globalized. The manufacturing companies need to be the-only-one-type companies with original skills and products. For that, it is of urgent necessity in the production field to construct an efficient production system including handing down of skill against “super-advanced age, fewer children” society and solve years’ problems of quality improvement (Q), cost reduction (C) and lead time shortening (D).

On order to contribute to the above solving and the activation of the industry, KAIZEN research was conducted for less-workload and sustainable high-productivity work environments which would make possible the continued employment of order workers and the establishment of its economic base, in cooperation with two smaller companies of construction machine attachment and manufacturing and agricultural machinery manufacturing and external research institutes.
2. METHODS

2.1. The approach

The research took the form of the cooperation of companies and external research institute. It was thought important for smaller companies in Hokkaido to participate in KAIZEN research along with third parties (universities or Hokkaido Industrial Research Institute). The cooperation would make it possible to obtain information unobtainable independently, generate incentive and motivation for improvement, and encourage sustainable improvement. Figure 1. shows the flow of this research.

2.2 The Ergoma Approach

The research was performed as in the following, based on the Ergoma Approach (M.Kumashiro,1987, K. MIKAMI 2002).

1) A joint labor-management improvement committee is set up by the third parties’ advice. For continuous improvement it is important for everyone from the top of the company to each employee to learn improvement awareness and improvement methods.
2) External researchers conducted an Ergoma investigation and give enlightenment lectures using the results of the investigation. In lectures they clarify the present problems, indicate improvement directions. Teach the manufacturing itself, and propose improvement methods or hints, which cultivates the employees’ motives & awareness for improvement and encourages their participation improvement & education activities.
3) The researchers present improvement plans using the results of the Ergoma, and have the trainees practice improvement activities for their own companies.
4) They have the trainees round off the results of their improvement for their own companies, and then lead them to independent improvement.

2.3 The target factories

The target factories were two. One manufactured construction machine attachments such as the one shown in Fig.2, and the other onion picker machines shown the one in Figure 3.
3. RESULT AND DISCUSSION

3.1 The construction machine manufacturing

The Ergoma Approach into the factory made the following clear.
1) In each process the workload was heavy, and there were many kinds of uneasy work postures causing shoulder or back aches.
2) A lot production for each process caused in-process items, which made the work place space less.
3) There was much wasteful crane movement or waiting time, which made the production inefficient.

Thereupon, we gave both enlightenment lectures to make the above known to all the employees and lead them into actual improvement activities, and idea lectures to present improvement ideas from the Ergoma, with the result that their KAIZEN awareness heightened and that it led to actual improvement activities.

The following shows the results of the KAIZEN performed actually.

3.1.1 Introduction of a flow production system and IC tag system

A flow production was introduced to reduce in-process items and increase productivity, which would reduce the stock, make the production flexible, and also enable the easy finding of inferior products in the previous process. IC tag production control system was also introduced (Shown in Figure 4.)

We investigated the effect after the introduction of the flow production system for the Z70 fork machine. Figure 5. shows the comparison of the Z70 fork machine decreased to 98 minutes from 142 minutes, which showed an increase of productivity by 1.4 times.

The IC tag production control system made it possible to save the making time of the daily work report and control the production progress in real time, which confirmed the usefulness of the system for waste less manufacturing.
Beside the above two, were incorporated 5 improvement about QCD including organization of a leader committee, exhaustiveness of 5 S’ activities and reduction of overtime work, and 11 items about workload reduction including development of a bending forging jig, establishment of a new jig storage, introduction of shot blasting and improvement of welding skills.

3.2 The agricultural machinery manufacturing

The Ergoma approach into this manufacturing as many as 60 problems clear. First of all, the improvement committee established through this research gave priority to how to hand down aging worker’s skills. We made a new process/work manual to make workers’ unwritten knowledge visible, and then began to examine how a new NC vender usable for DAD /CAM would work because older workers complained about the heavy workload of the bending work the most. It was thought that the effect of the introduction would be the following.

3.2.1 Introduction of a new NC vender

1) CAD / CAM would enable the control of the process & work procedure and blueprint/ Material information. This would make workers’ unwritten knowledge visible, and lead to skill handing down.
2) Using the information input by CAD/CAM, anybody would be able to make highly precise components without any experience or instincts.
3) The bending condition of a material would appear on the screen, which would lead to no work errors.
4) No need to hold the heavy punch would lead to little holding burden and safety.

The NC vender introduced is shown in Figure 6. The monitor screen of the NC vender introduced is shown in Figure. 7 Table 1. shows the results of the effect measurement of the NC vendor.

The work posture burden evaluation indices (K. MIKAMI, et al., 1998) of both the experienced worker and the beginner showed decreases in workload, and the working time showed increases in productivity. We also measured the time an older worker with no experience of the NC vender needed to be able to do the works by himself. An experienced worker is teaching a beginner in Fig. 8.

The result was that he mastered the work in about 30 minutes. About 3 years was needed to master it before. Besides, 10 important items about QCD and workload reduction were incorporated here.
Table 1. The results of the effect measurement

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<th>Experienced</th>
<th></th>
<th>Beginner</th>
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<td></td>
<td>Evaluation index</td>
<td>Time (min)</td>
<td>Evaluation index</td>
<td>Time (min)</td>
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<td>The former vender</td>
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<td>18.0</td>
<td>88.87</td>
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<td>The NC vender</td>
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<td>10.2</td>
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<td>16.5</td>
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<tr>
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<td>-43.0%</td>
<td>-14.56%</td>
<td>-30.0%</td>
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4. CONCLUSION

1) In the Construction machine attachment manufacturing were incorporated through the lectures 5 improvement items about QCD of “organization of a leader group”, ”introduction of a flow production system”, “exhaustiveness of 5S’ activities”, “improvement briefings” And “reduction of overtime work”, and 11 items about workload reduction of “introduction of an IC tag production control system”, “introduction of shot blasting”, “development of a box for finished products”, “development of a bending forging jig”, “improvement of the welding technique”, “Making of a work manual”, etc.

2) In the agricultural machinery manufacturing were incorporated through the lectures 10 improvement items of “organization of a workshop”, “introduction of a NC vender”, “development of a movable storing table for punches”, Making of a movable work table”, “Arrangement of waste place”, “Making of jig storage”, etc.
3) The enlightenment activities with the Ergoma by the outside researchers led to the employees’ own KAIZEN activities, and then to fostering of the company KAIZEN climate for a sustainable production field construction. It is thought that this KAIZEN corroboration in cooperation with smaller companies and outside research institutes plays a significant role in the activation of the manufacturing.

5 REFERENCES

