Study on Standstill Conditions in Kaizen Activity: Through Case Studies of Two Companies in their Long-Term Efforts

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ABSTRACT
Multiple prior studies stress that continued Kaizen activity is conducive to building and maintaining competitive advantages of manufacturing companies. Meanwhile, it remains unclear as to what kind of management factors may exert impact on sustainment of Kaizen activity. This paper discusses a study conducted on the cases of two manufacturing lines, where such activity has been continued for more than ten years. At first, it was discovered that study period was divided into different periods. It was also found out that ‘standstill conditions’ which prevent smooth progress of activity exist in many periods, and that such conditions are hard to avoid. The study went on to categorize progress of activity in each period into different patterns, including at which points standstill conditions occurred, thereby, circumstances of standstill conditions were made clear. This paper verified a detailed process of Kaizen activity development in each period and the relationship between that detailed process and points of occurrence of standstill conditions. Thought was also given to factors and actions for smooth development, and effects brought about by overcoming such challenges. Lastly, consideration was given to the future perspectives of the study for elucidating how better Kaizen activity may be managed for continuation.

Keywords: Management of Kaizen Activity, Standstill Conditions, Continuation of Kaizen Activity, Case study, Process of Kaizen Activity Development

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1. BACKGROUND AND PURPOSE OF THIS STUDY

1.1 Background
In advanced countries, against the backdrop of intensifying competitive situation and high risk involved in heavy investment for further growth, many manufacturing companies recognize the importance of, and choose to carry out, vigorous Kaizen activity as a measure for increasing their competitiveness (ex. Kojo Kanri, Oct. edition, 2005). With a focus given to the continuation of Kaizen activity in business practice, sustaining such activity and making it part of corporate culture is a big challenge to many practitioners including the top management (Takahara, 2009).

As regards effects brought by sustenance and continuation of Kaizen activity, the authors made reference to prior studies and found an article which points out that accumulation and repetition of small Kaizen lead to out-
standing Kaizen and bring about significant results, as in ‘Often, major improvements take place over time as a result of numerous incremental improvements.’ (Byuiyan and Baghel, 2005). It is also pointed out that ‘Manufacturers have realized that the key to creating competitive advantage through operations lies in developing distinctive capabilities... the deep knowledge that is developed allows the operation to adapt to new requirements, remain flexible as business requirements change, and develop new capabilities through experimentation and local invention.’ (Upton and MaAfee, 2000). All of these studies suggest that sustenance and continuation of Kaizen activity give favorable impact on further activity, results and organizational capability.

In the meantime, many statements and cases indicate that effectiveness diminishes gradually during such activity, in those cases there were some cases that Kaizen activity could not progress without sufficient level of support from management and appropriate motivation of workers. (As an example, Kono, 1998a, 1998b).

All of these prove that, while continuing Kaizen activity is highly evaluated and known to be effective, it is difficult to continue such activity. What remains to be a challenge for study is identification of the management style required to continue improvement activity.

1.2 Problem Awareness and Purpose of Study

Based on the above conditions, the following two questions came to the minds of authors.

The first question is how activity is carried out in successfully continued cases, and which activity is involved the suspected presence of bottlenecks hampering continuation of activity. This thought arose when authors wondered if, in the presence of difficulties associated with continuing Kaizen activity, bottlenecks may be found even in those cases which are considered to be generally successful.

The second question is how companies overcome those negative conditions. The thought that those which are good at overcoming them should be successful in continuing Kaizen activity over an extended time led to the authors’ problem awareness.

The first purpose of this study is to clarify whether those negative conditions arise in sustained cases and circumstances that such bottlenecks occur. This purpose is because the authors thought that clarifying when difficulties in sustaining Kaizen arise may provide foundation for analyzing the success.

The second purpose is to make clear how to evade situations affecting continuation of the activity and if any sort of effects are brought out by overcoming such bottlenecks. The former purpose (i.e., how to evade negative situation) are divided into “what actions to be taken for overcoming such negative conditions and what factors to support for actions in overcoming such challenges” and “what factors to support for not falling into standstill conditions.” Based on those analysis, effects by overcoming bottlenecks are enquired.

Then, the last purpose of this study is to give thought to directions the study should move into based on the result of this study, for identifying the style of management conducive to continuing improvement activity. It shows the viewpoints required to move the study ahead for clarifying such management based on the result of this study.

The study has been conducted with these three purposes in mind.

2. STUDY METHODOLOGY

2.1 Definitions

Prior to the study, two terms, ‘Kaizen activity’ and ‘continuation’ were defined.1

The term ‘Kaizen activity’ is defined as general programs for improvement, not limited to specific ones, such as TQC or TPM. It is because, typically, manufacturing companies implement different types of programs in combination as they continue Kaizen activity. Considering Boer (2000), and based on Yamaguchi (2015), the term ‘Kaizen activity’ was defined as ‘a systematic process planned and organized on a company-wide basis progressively, for improving operational competitive indices, i.e. Q (quality), C (cost), D (delivery), and F (flexibility).’

In this study, based on Yamaguchi (2015), the term ‘continuation’ was defined as ‘maintaining the process for furthering Kaizen beyond the turnover period of people in charge and management members (around three to five years) typically found in companies’. This is based on the thinking that a fundamental condition required for long-term continuation of Kaizen activity is that the activity does not get interrupted by the replacement of promoters and/or superiors.

2.2 Overview of Subjects of Study: 2 Lines in 2 Companies

As subjects of Study, a single line from each of two companies was chosen: 1) a line in plant A of precision parts manufacturer A (hereafter referred to as line A), the period under study was eleven years from 2001 to 2012; 2) a line in plant B of precision machinery manufacturer B (hereafter referred to as line B), the period was twelve years from 2000 to 2012.

Cases which sustained Kaizen activities for over ten years were selected, because they are suitable for the purpose of this study which require analysis of situations in
which continuation of activity is challenged and how such challenges are overcome. Then, focused analysis on a single line is to examine factors closely contributing to the conduct and continuation of activity, as well as for looking into impact brought about by continued activity. These two lines were chosen because, first of all, both of them produced an outstanding result from continued activity. Next, both of them have abundant internal documents, which allow objective analysis of the lines. Lastly, they were chosen because there were key persons who took the lead throughout the period under study.

The way how study was conducted is as follows:

First, authors visited the lines several times, received explanation about the history of Kaizen activity, visited facilities related to the activity, and reviewed their documents. Then, authors interviewed several people concerned including a key person in each line to confirm the progress of activity while ensuring to maintain an objective perspective, as well as securing accuracy by asking the companies to check the interview records prepared.

3. METHOD OF ANALYSIS

The process of analysis of the two cases under study is described below.

3.1 Organizing Interview Results in Chronological Order

The first thing done was to organize interview results in chronological order. In so doing, study period was divided into different phases. Interview results, journal articles, internal documents, etc. concerning the development of the two lines were used to establish different categories, based on which the study period was divided into phases. This resulted in seven phases and five phases for line A and line B, respectively (for example line A, shown on the left side of Table 1). Then, interview records were organized into those phases.

3.2 Division Into Different Periods

Next, having checked actual improvement efforts at each phase, it was discovered that the repeated process of specific activity promoting Kaizen activity and producing results existed. It was also observed that, while there was one process in a given phase in some cases, there were multiple processes found in a phase in others.

Based on the above, thinking that the process from tackling a specific activity to producing results might constitute a unit in understanding the development of Kaizen activity, authors decided to subdivide each phase further.

This resulted in subdividing each phase of Line A and B into 12 and 6 periods, respectively, which was organized into the ‘Phase Division Table’. (Table 1 is an example for line A.)

3.3 Focus on Standstill Conditions

Next, authors looked into each time period divided above.

Interview records proved that, while total stoppage of activity was not found, ‘standstill conditions’ which hampered smooth progress existed. The term ‘standstill

<table>
<thead>
<tr>
<th>Phase</th>
<th>Period</th>
<th>Content of Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>1</td>
<td>Layout improvement</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Setup operation improvement</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Handling of bottlenecks</td>
</tr>
<tr>
<td>II</td>
<td>4</td>
<td>Development and introduction of equipment for efficient equipment operation (from other company)</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>Development and introduction of equipment for further efficient equipment operation (from other company)</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>Realization of automated discharge</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>Improvement of points where mechanism can be improved</td>
</tr>
<tr>
<td>III</td>
<td>8</td>
<td>Measures on human errors</td>
</tr>
<tr>
<td>IV</td>
<td>9</td>
<td>Output inspection process (bottleneck) improvement</td>
</tr>
<tr>
<td>V</td>
<td>10</td>
<td>New product design with reduced part items</td>
</tr>
<tr>
<td>VI</td>
<td>11</td>
<td>Improvement of difficult points to operate for mass production</td>
</tr>
<tr>
<td>VII</td>
<td>12</td>
<td>Improvement by splitting process into two for achieving target cycle time</td>
</tr>
</tbody>
</table>

Table 1. Phase division Table (Line A)
conditions’ is defined as ‘the state where longer than a certain time has passed’ without clear definition of individuals, groups or departments/organizations who/which take on the responsibility for effective activity in achieving development and results.’ Nine and four standstill conditions were found in line A and B, respectively. Although one can say that these two lines were outstanding in terms of continuation and result of Kaizen activity, it is clear that even in those lines, standstill conditions preventing the smooth progress and continuation were found.

The above analysis led authors to come up with a hypothetical idea that ‘to evade standstill conditions’, which is concretely ‘to develop Kaizen activities without such negative conditions’ and ‘to overcome them soon when occurred’, is crucial in continuing Kaizen activity.

Based on that idea, each case was analyzed with a focus on standstill conditions. Investigation of 13 standstill conditions revealed that actions taken immediately before them did not cause negative effects, that such conditions occurred suddenly during the course of steady progress of activity and that actions taken after such conditions helped overcoming them.

Authors, then, inferred that it is so difficult to clarify the state of standstill conditions by analyzing action taken before that challenging situations, and organized actions for overcoming standstill conditions. As a consequence, the first involves the lack of equipment which can resolve the trouble condition. The second is the case where actions for resolving troubles or decisions for such actions are on hold, waiting for the upper management to decide. The last is the case where trouble conditions, and/or causes thereof, are not understood, and therefore, topics of Kaizen activity cannot be determined. The above three were identified as circumstances leading to standstill conditions.

Next, consideration was given if the three circumstances leading to standstill conditions could have been avoided. In each circumstance, standstill conditions occurred in the process of issues/troubles not experienced before in the history of Kaizen activity and the occurrence of such negative conditions triggered actions for overcoming them. Conclusion was that standstill conditions were difficult to avoid.

3.4 Analysis of Activity Progress in Each Period

In the above section, standstill conditions were found in the development of Kaizen activities at divided time periods. However, to clarify “what factors to support for not
falling into standstill conditions” is one purpose of this study. Therefore, it is necessary for a framework to understand and look more deeply into each time period of Kaizen activity, including both standstill conditions and smooth conditions. Authors, then, went on to delve into interview records and internal documents, to examine if there were any rules in the way Kaizen activity developed in each period.

As a result, it was discovered that content of Kaizen leading to improvement results in each period consist of combination of specific improvement areas (abbreviated as IA) and methods (abbreviated as MT). Authors reorganized content of activity as combinations of IA and MT. (Table 2 shows combinations of IA and MT in each period in Line A.)

Next, examination of Kaizen activity with a focus on IA and MT made clear that, although IA and MT were fixed at the beginning of the period in some cases, in most of the cases, Kaizen activity had been started without prior planning, before deciding on the content or methods, which were decided gradually as the activity progressed.

It was also clarified that standstill conditions were found when more than a certain time had passed without defining individuals or departments/organizations which are expected to decide IA and MT.

Investigation was made to see which of the two, i.e. improvement area or method, were identified first in each period. As a result, three types of periods were found: 1) ‘where improvement area and method were determined at the same time’; 2) ‘where improvement area was determined first, followed by method; and 3) ‘method was determined first, followed by improvement area’. It was also confirmed that standstill conditions occurred before determination of IA and/or MT. A table was prepared to show the chronological relationships between IA and MT, as well as time points at which standstill conditions occurred (Table 3: Example of Line A).

The item ‘order’ located between ‘improvement area’ and ‘method’ represents the order of determining improvement area and method. The sign ‘=’ represents that they were determined at the same time, while the sign ‘‘ represents that they were determined at the same time, while the sign ‘→’ indicates that improvement area was determined be-

<table>
<thead>
<tr>
<th>Period</th>
<th>Content of Activity</th>
<th>Improvement Area</th>
<th>Order</th>
<th>Methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>○ Layout improvement</td>
<td>= ○ Bringing two adjacent processes closer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>○ Setup operation</td>
<td>= ○ Commonization of setup procedure/one-touch setup</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>○ Handling of bottlenecks</td>
<td>= ○ Use of IE method (ECRS)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>○ Equipment operation</td>
<td>← △ Development and introduction of equipment for increased efficiency of equipment operation learned through visit to other companies</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>○ Equipment operation</td>
<td>← △ Development and introduction of equipment for further improvement of efficiency of equipment operation after learning from other companies</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>○ Realization of automated discharge</td>
<td>→ △ Development and introduction of gravity transfer system by using mechanism learned through visit to other companies</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>○ Points where mechanism can be improved</td>
<td>← △ Building equipment with mechanism</td>
<td></td>
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<tr>
<td>8</td>
<td>△ Measures on human errors</td>
<td>→ ○ Building equipment with mechanism</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>△ Output inspection process (bottleneck)</td>
<td>→ ○ In-house production of inspection machine</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>○ Reduction of part items</td>
<td>→ △ New product design</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>△ Points difficult to operate for realizing cycle time suitable for mass production</td>
<td>→ ○ Building equipment with mechanism, etc.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>○ Splitting process into two for improvement to achieve target cycle time</td>
<td>← △ Building line with limited transfer distance</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
fore method, and the sign ‘←’ shows vice versa. Signs ‘○’ and ‘△’ in columns on the left side of ‘improvement area’ and ‘method’ represent whether or not standstill conditions existed. The sign ‘○’ means that the improvement area or methods were determined smoothly without standstill conditions, while the one ‘△’ means that standstill conditions occurred before determination of either improvement areas or methods were determined, and then, improvement areas or methods were decided after overcoming such standstill.

3.5 Categorization of the Development of Activity

Next, activity was categorized into several patterns, depending on which of the two, IA or MT, was determined first, as well as on whether or not standstill conditions occurred before determination of IA and/or MT, for the different periods of two lines (Table 4).

It was found out that standstill conditions did not occur where improvement areas and methods were determined at the same time (pattern X), while where either improvement areas or methods were decided first (patterns Y and Z), there were two cases, i.e. 1) no standstill conditions occurred at all at the time of decisions (○); and 2) standstill conditions occurred which were overcome later (△). Considering the above result, logical thinking led to nine different patterns, namely, X, Ys→Yv, Zs→Zv. Each individual period of the two lines was categorized according to the patterns. It was confirmed that, in line A, four patterns of X, Yt, Yu, and Zt were found, while in line B, three patterns of X, Ys, and Yu existed.

3.6 Analysis of Circumstances of Standstill Conditions

The study went into the next step of clarifying circumstances of failing into standstill conditions. It was conducted by looking into what type of process was going smoothly before standstill conditions, why standstill conditions emerged despite the smooth progress, and how standstill conditions were overcome and smooth progress was recovered, for every pattern identified in the Table 4.

First of all, regarding Yt, i.e. the standstill conditions after determination of IA and before that of MT, it was confirmed that, in both applicable periods, such conditions resulted from the lack of individuals familiar with methods suitable to the improvement areas. It was necessary to get help from other departments or from outside the company for obtaining methods suitable to the improvement areas, and the standstill conditions were caused by waiting for actions or decisions to be made by the upper management for solution beyond the organizational boundary.

Next, it became clear that Yu, standstill conditions which occurred before determination of IA, while people were aware of trouble(s) existing in the workplace, they were unable to identify IA. It was understood that people concerned were waiting for upper management’s decision on actions to be taken for overcoming such conditions.

Zt, standstill conditions before determination of MT, is the condition where people, having eliminated all Muda (waste) in operations based on the conventional definition of Muda, were unable to ‘see’ troubles in their workshops. As a countermeasure, introduction of new method for identifying IA was necessary, but people were kept on holding waiting for the decision by the upper management as to which method should be introduced, thus causing the standstill conditions.

As shown above, circumstances of standstill conditions were clarified for every development pattern. The study also revealed the fact that the process of determining IA can be broken down into two steps, i.e. step of ‘Being aware of trouble conditions’ and that of ‘Identifying IA’ (Figure 1).

Based on the understanding that the development of Kaizen activity in each period consists of ‘determination of improvement areas’ and ‘methods’, and that the process of determining improvement areas can be broken down into ‘Being aware of trouble conditions’ and ‘Identifying improvement areas’, development and standstill conditions of each period corresponding to patterns Yt, Yu and Zt were organized.
Yt is the pattern where IA is determined before standstill conditions occurred, which means that while people were ‘aware of trouble conditions’ and smoothly went on to identifying IA, they fell into standstill conditions without reaching ‘determination of methods’. It was learned that they subsequently overcame standstill conditions and determined methods, producing activity results.

Meanwhile, it was found out that in Yu, although people were ‘aware of trouble conditions’, they fell into standstill conditions before reaching ‘identification of IA’. Subsequently, they overcame standstill conditions to enable ‘identification of IA’, and went on to ‘determination of methods’ and produced activity results.

Lastly in Zt, MT was determined after overcoming standstill conditions, and the standstill conditions were those in which people were not ‘aware of trouble conditions’, and therefore, could not move on to determination of IA. The process followed in this case was, ‘determination of MT’, ‘awareness of trouble conditions’ triggered by the MT, and then ‘identification of IA’ in this order.

What follows is an illustration of where standstill conditions occurred in the above three patterns (Figure 2). Pattern symbols below arrows indicate where standstill conditions occurred. In the case of Yt and Yu, standstill conditions occurred at points shown by arrows and were overcome, then the remaining process in the diagram was followed until the end. In the case of Zt, however, after standstill conditions were experienced before ‘awareness of trouble conditions’, the process shown in the diagram was not followed. Instead, it seems that the case followed the process of ‘determination of method’ → ‘awareness of trouble conditions’ → ‘identification of improvement area.’

3.7 Actions for Overcoming Standstill Conditions and Contributing Factors

As shown 3.3, thirteen standstill conditions were found in both cases under study, but it should be noted that Kaizen activity resumed smoothly without a hitch after overcoming them (the signs ‘△’ in Table 4 are applicable to this situation) and that no standstill conditions occur in determining IA and MT (the signs ‘○’ in Table 4 are applicable to).

These examples show that both being able to overcome standstill conditions quickly after falling into them (hereinafter, ‘overcoming standstill conditions’) and being not to fall into standstill conditions (hereinafter, ‘smooth activity development’) are important in the long-term continuation of activity in the two lines. Authors, then, took approach to extract actions and factors contributing for both ‘overcoming standstill conditions’ and ‘smooth activity development’ (which are collectively called, hereinafter, ‘avoiding standstill conditions’). This section respectively discusses actions taken in overcoming standstill conditions (direct factors) and factors contributing to overcoming them (indirect factors).

Authors studied what kind of actions there were in overcoming standstill conditions (direct factors) by the development pattern. Actions taken in pattern Yt included decisions made by upper management concerning the adoption of new methods or expanding cooperating departments. As regards Yu, decision-making by the upper management concerning expansion of cooperating departments and what to do after that proved to be an action for overcoming the standstill conditions. Standstill conditions of Zt were found to be overcome by decision-making concerning the adoption of new methods. What is common among these patterns is decision-making by the upper management.

Authors then went on to think about factors which supported overcoming standstill conditions (indirect factors). It is based on the belief that, while decision-making by the upper management directly led to overcoming standstill conditions, there could be some factors which assisted the direct factors. Indirect factors were also examined by the activity development pattern, and the following four factors were identified.

The first factor is ‘skills and knowledge’ of upper managers. Good understanding about actual conditions in workshops, which is a prerequisite for proper decision making, as well as knowledge and ability of judgement on things to be decided, provide support to decision-making for overcoming standstill conditions. The second factor is ‘existence of systems/structures to obtain involvement of upper management and other people concerned’. In other words, it was discovered that systems/structures existed providing opportunity to vertical organization (upper managers) and horizontal ones (people concerned) to take part in Kaizen activity. The third factor is ‘trust won by other departments based on the past Kaizen results’. It became clear that the basis of the expansion of cooperating departments was the confidence won by such departments in Kaizen activity itself through good results obtained from the past Kaizen activity, making it easy to get their cooperation. The above three factors cannot be made ready in one day after standstill conditions are experienced. These three which have gained or build in former period are utilized. Therefore, they are the result of ‘accumulation’ in the organization.

The forth and the last indirect factor is ‘an event which happened by chance’. Examples include: one in which people concerned happened to visit another company and learned about equipment or tools applicable to their own workshop; and one in which a leader of a project who happened to be transferred to the section within the manufacturing department serving as contact to the sales department became aware of something important. This fourth factor is of a different nature from the first to third ones which are the result of ‘accumulation’.

...
The presence of ‘accumulation’ before\textsuperscript{13} and after\textsuperscript{14} such accidental event, however, proved to be contributive to overcoming standstill conditions. This demonstrates that, while event which happens by chance may help in overcoming standstill conditions in Kaizen activity, ‘accumulation’ plays an important role in generating or making use of such accidental event.

3.8 Background of Smooth Activity Development

The study continued to analyze factors lying behind ‘smooth activity development’ in the two lines which is another type of ‘avoiding standstill conditions’.

The analysis involved identifying factors which supported smooth progress of activity by process in each period, by dividing processes into ‘up to awareness of trouble conditions’, ‘up to identification of improvement area’, and ‘up to determination of method’. Specifically, interview records were reviewed to find out the content of activity in the course of activity, and for each of such content, factors which contributed to the progress of activity were identified.

The result of the analysis of factors contributing to the smooth progress by pattern revealed that, periods can be classified broadly into two, i.e. Ys, Yt, and Yu in one group, and Zt and X in another.

First of all, factors identified in the Ys, Yt, and Yu patterns will be organized by process. Factors which helped smooth progress until generating ‘awareness of trouble conditions’ include: ‘mechanism which allows objective understanding of daily situation’, ‘systems/structures which allows involvement of upper managers and other people concerned who support objective understanding’ and ‘existence of equipment/tools produced as a result of earlier Kaizen activity’. Analysis of factors leading to the smooth progress up to ‘identification of improvement areas’ clarified that they can be grouped into two: i.e. ‘systems/structures which enable involvement of upper managers and other departments (for supporting the identification of improvement areas)’; and ‘existence of equipment/tools produced as a result of earlier Kaizen activity’. Last, analysis of factors helping the smooth support up to ‘determination of methods’ after identification of improvement areas resulted in two types: ‘existence of skills and knowledge about methods in house’; and ‘systems/structures allowing the involvement of skilled people and upper managers’. All of these factors were found to be similar to those which help overcoming standstill conditions discussed in 3.7 as ‘accumulation’; in fact, many factors were common to factors contributing to overcoming standstill conditions.

Next, concerning factors which supported smooth progress in pattern Zt and X, it was discovered that in both cases, methods introduced supported in determining improvement areas (awareness of trouble conditions and identification of improvement areas). What differed between the two was in timing: that is, while in Zt, improvement areas were determined after a while following determination of methods, in X\textsuperscript{21}, improvement areas were determined at the same time with the decision of methods.

3.9 Effects of Overcoming Standstill Conditions

At the end of analysis, effects of overcoming standstill conditions were examined. It is based on the thought that, although sections from 3.4 through 3.8 dealt with standstill conditions as something to be avoided, having fallen into standstill conditions might have brought about some positive effects to both lines.

Specifically, analysis was conducted from the viewpoint of whether or not something arose from overcoming standstill conditions which supported smooth progress afterwards. As a result, it was discovered that there are broadly four areas\textsuperscript{22} in which benefits of overcoming standstill conditions were accumulated.

Good influence given by overcoming standstill conditions was observed in 12 periods, which is more than half of the total number of periods in two lines (18). Many items on which these four areas influence are directly linked to the ‘accumulation’ of Kaizen activity in both lines.

The above proves that a great deal of positive impact is given by overcoming standstill conditions in terms of the scope of impact and the degree. It seems correct to say that a great benefit is reaped from overcoming standstill conditions after falling into them.

4. DISCUSSION

This section deals with characteristics of this study based on the result discussed in the previous section, and give consideration to viewpoints needed for furthering study on the management for continuation of Kaizen activity as knowledge obtained in this study.

The first characteristic of this study is that it presents process items which generate activity results through ‘awareness of trouble conditions’, ‘identification of improvement areas’ and ‘determination of methods’ contained in sustained Kaizen activity, and then it categorizes organizes the relationship between detailed activity processes and points at which standstill conditions occur. In other words, the study provides a ‘common framework for understanding activity progress conditions’ for individual cases of Kaizen activity.

The second characteristic of this study is that it emphasizes the existence of ‘accumulation’ which give impact on continuing Kaizen activity. ‘Accumulation’ refers to everything accumulated from the past, including skills
and knowledge, systems/structures which allow involving upper managers and other people concerned, confidence won by the people concerned on Kaizen activity, mechanism which allows grasping daily operational conditions, and equipment/tools produced in the past. Such accumulation from the past has been proven to make significant contribution to overcoming of standstill conditions and smooth progress.

To summarize, characteristics of this study is that it presents two viewpoints about progress and continuation of Kaizen activity: a framework which helps understanding the result side, which is progress conditions; and accumulation on the cause side.

Based on knowledge obtained by these characteristics of this study, some future study perspectives have surfaced. The first one is to compare and analyze Kaizen activity in different periods and different cases using the ‘framework for understanding progress conditions’ as a foundation. To illustrate this, while there are three progress patterns in Line A in which standstill conditions were found, i.e. Ys, Yu, and Zt, there is only one in Line B, which is Yu. Based on that both two lines were cases that sustained Kaizen activity for long time, two cases lead us to presume that there would be some different approaches for sustaining kaizen activity. More concretely, this brings up hypotheses on differences in activity and strengths of two companies’ organizational capability between cases, that ‘Line A might have ability to identify improvement areas after getting awareness of trouble conditions, as well as to introduce methods even where they are not aware of trouble conditions’, and that ‘Line B might have strength in constantly developing awareness’. Thus, understanding the progress conditions of different Kaizen activity using a common framework and making comparison is a perspective that the future study should have.

The second possible perspective is to pay attention to both cause side, i.e. accumulation, and result side. Specifically, with a focus on the relationship between Kaizen activity detailed processes and progress conditions, and accumulation, it may be worthwhile analyzing differences in accumulation of cases where Kaizen activity went successful and those in which the activity became stagnant. This includes examining what kind of impact improvement methods adopted by companies, such as 5S, TPS, and TPM, give to accumulation, as well as to progress of the detailed activity process.

The third perspective for future study is to analyze the dynamic relationship between accumulation and progress of activity. Study of effects of overcoming standstill conditions discussed in 3.9 indicates that accumulation impacts on the progress of Kaizen activity, while in turn, progress of Kaizen activity impacts on accumulation. To clarify the dynamic relationship between accumulation and progress would also be another perspective of research obtained from this study.

5. CONCLUSION

This study was conducted based on the case study of two production lines where Kaizen activity had been continued for more than ten years. First of all, activity progress of the two lines were divided into different periods, and it was found out that even in those lines successful in long-term continuation producing significant results, existence of standstill conditions hampering steady progress of activity was found, and that such standstill conditions were unavoidable. Secondly, it was found out that activity of each period can be divided into the period of decision of improvement areas and that of methods, and activity progress was categorized based on the order of decision of improvement areas and methods, as well as the time points at which standstill conditions took place. Next, ‘circumstances of standstill conditions’ were revealed, and at the same time, it was confirmed that activity of each period can be broken down into processes of ‘awareness of trouble conditions’, ‘identification of improvement areas’ and ‘determination of methods’.

Authors went to think that in the background of long-term sustaining Kaizen activities in those two cases there were two types of being able to overcome standstill conditions quickly after falling into them (‘overcoming standstill conditions’) and being not to fall into standstill conditions (‘smooth activity development’), then, extracted actions and factors supporting these two types. As a result, it was discovered that ‘accumulation’ in house (which were, for instance, skills and knowledge, systems/structure for collaboration and trust won by other departments based on the past Kaizen results) played important roles. Furthermore, effects of overcoming standstill conditions examined to generate a great benefit through formed ‘accumulation’ in overcoming such negative conditions.

At first, an achievement of this study is that it presents existence of standstill conditions was found even in two successful cases and inevitability of such challenging conditions.

Second achievement is that it shows a framework for understanding development processes of Kaizen activity including standstill conditions, which enables to grasp objectively progress and continuation of Kaizen activities (that is the output side of Kaizen activities’ management).

Third one is that the study emphasizes the importance of ‘accumulation’ in continuing Kaizen activity. Based on this achievement, a viewpoint enabling to get hold of input side of Kaizen activities’ management for their progress and continuation was obtained.

Last one is that, based on three above achievements as the foundation, three perspectives has been presented for future study for elucidation of how Kaizen activity should be managed for continuing it.

This paper has limitation that subjects of study are
based on two successful cases. Therefore, the framework presented in this study is described as a hypothetical one and extracted ‘accumulations’ are of exemplification. Authors expect to continue study in those perspectives even for verifying research findings of this study.

REFERENCES

Bhuiyan, N. and Baghel, A. (2005), An overview of continuous improvement: From the past to the present, Management Decision, 43(5), 761-771.


APPENDIX

1. The word ‘systematic’ is used in definition to mean that different functions are organically coordinated.
2. Though there are some methods that are to grasp the trend of the progress of Kaizen activity of plural lines or whole factory as the subject of the study, in this paper, researches that clarified specifically whether Kaizen activity of each single line was progressed or not and why did or didn't so, were conducted. This selection of the subject of the study is for making clear the situation and factors of the progress of Kaizen activity.
3. ‘Longer than certain time has passed’ refers to the elapse of time of more than a month, or where subjective expressions are found in interview records, such as ‘at long last (concerning description of progress)’ or ‘at the end of a lot of thinking’, suggesting that it took time in carrying out the activity in question.
4. Standstill conditions occurred one each through period 4 to period 12 of Line A, while they took place one each in period 2, 3, 5, and 6 of Line B.
5. In those two companies of the subject of this study, those monetary incentives (direct incentives) were nominal account. However, in two companies, to achieve targets of Kaizen activity was an important part of the performance evaluation of plants, teams and individuals, then, there were enough indirect incentives for Kaizen activity. Moreover, in those two lines, there were both enough level of support from management to keep up motivation of workers, hence it is characteristic of standstill conditions that happened under such circumstances.
6. In the two lines under study, no example was observed in which people were unable to overcome standstill conditions and the activity became stagnant, and therefore, there are only two cases of ‘○’ and ‘△’.
7. For grasping the condition where people were unable to ‘see’ troubles in their workshops’, the quantitative assessment such as the Likert scale were not adopted in this interview, but the dichotomy ‘whether or not troubles in their workshop were recognized’ analyzed in this interview records, was utilized. Through two cases of this study, the situation of not-being aware of problematic situation was attendant circumstances of progressed Kaizen activity where recognized problems were resolved.
8. A case in point is decision-making for involving the design department in developing a new product for drastic reduction in the number of parts used.
9. An example of this is the decision made by the upper management to summon a part supplier for confirmation of quality based on the principle of ‘Genbutsu’ (actual workshop and actual product), when an assembly defect, which had been experienced before occasionally, happened again.
10. Decision-making for implementing training on equipment with mechanism for operators is an actual example. Having operators understand efficient operation through using the equipment allows them to realize issues in their operation and find the proper application of the equipment with mechanism.
11. Since no specific features were observed according to the development pattern, these indirect factors may be common contributing factors irrespective of development patterns.
12. A specific example is that, before people learned about equipment/tools applicable to their own operations in another company they happened to visit, the system (accumulation) existed in the company for visiting other companies regularly.
13. A case in point is an ‘accumulation’ of Improvement Guidance Board. How it works is that, after an event of a person getting awareness in the section within the manufacturing department serving as contact to the sales department after his transference, he shares such information with others and makes use of the Board which supports the process until the decision of improvement area.
14. Specifically, such mechanism includes: existence of indices for measuring actual operational conditions and visualization methods, and periodical understanding of operational conditions through them; sharing of defect information; new product start up by purposefully using existing equipment, instead of building a new setup, for letting issues/troubles surface, and introduction of more efficient equipment into operations.
15. Actual examples include: management of Kaizen activity using indices for measuring operational conditions; support for Kaizen through Kaizen activity promotion organization; and existence of a system for requesting the engineering department for analysis of causes of trouble conditions.
16. The case in point was that people noticed the waste of their daily operations by looking at the equipment/tools made as a result of past Kaizen activity.
17. Since Yu is the pattern of falling into standstill conditions before ‘identification of improvement areas’, only Ys and Yt were included in the analysis.
18. In the same way as appendix 14, people identified where waste existed in their daily operations by looking at the equipment.
19. Since Zt is the pattern in which methods were determined before improvement areas, only Yu and Ys were included in the analysis.
20. The methodology adopted in pattern X is widely used also by other companies in Kaizen activity, and
it proves to be a powerful driver of activity, since the method and decision of improvement area combined lead directly to improvement effects. Meanwhile, all four periods concerned belonged to an early stage soon after the full-scale start of Kaizen activity, and therefore, relevant lines had large areas of improvement, which is why, such a powerful method with wide applicability is considered to be possible.

21. There were three areas influence adopted by Line A: introduction of equipment with mechanism (including accumulation of good influence indicated in footnote 18); evolution of equipment for increased efficiency of parts setup; and introduction of new design with reduced number of parts and its effects. In Line B, there was one area, i.e. expansion of inter-departmental collaboration system.