Key Success Factors to Promote Knowledge Co-creation in Technology Development Organizations

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Abstract--**It goes without saying that technology companies are expected to innovate. However, the technical personnel need to follow the internal regulations of the company, which can conflict with the goal of innovation. Therefore, when a company changes its system of internal control, a technical organization learns new ways to work under the new system. This study aims to find the success factors for keeping workers complying with company regulations and improving the organizational climate for innovation when the corporate management system changes. We conducted longitudinal action research from 2009 to 2013 in a Japanese manufacturing company consisting of 50 business units and approximately 8,000 employees. Knowledge co-creation among employees and power relationships between managers and followers are units of analysis in this study. In the results, we found the headquarters plays an important role in creating an organizational climate where technical personnel can easily act under limited autonomy. In addition, the employees of the organization who understand how to comply with regulations can co-create new knowledge for innovation.**

I. INTRODUCTION

Technology oriented organizations need to differentiate themselves from their competitors continuously. The sources of the differentiation are tangible assets including advanced technologies and patents produced through innovation. These tangible assets must be managed under an appropriate internal control system. This is because all employees in business units, especially technical personnel, need to handle important technical information cautiously in order to prevent information leakage. When the system changes in a company, technical personnel must quickly learn and behave in accordance with the new structures.

In general, top managers intended to introduce the internal control as organizational strategies (eg. [1]). Regarding organizational strategy, Lewin's Three-Step Change Theory describes the process of disconfirming a person's former belief system: (i)Unfreezing, (ii) Changing, and (iii) Refreezing [2][3]. Lewin's model illustrates the effects of forces that either promote or inhibit changes. Especially, driving forces promote change while restraining forces oppose change. The communication strategies between top and employees are important to unfreeze their current belief system so that the organizational climate can be changed immediately.[4]

As an application research, this paper focuses on communication strategies for making technical personnel consciously comply with control systems. Technical personnel understand that compliance is important for corporate work. However, since technical personnel need to produce new products and processes, they tend to prioritize innovation over regulatory compliance. Therefore, the headquarters instructs and coaches them to keep their work in compliance with rules as much as possible.

We employ the concept of knowledge co-creation (KCC) [5][6], meaning the transition process from tacit knowledge to explicit knowledge through co-creative activities between agents. The aim of this paper is to find success factors for keeping workers complying with company regulations and improving the organizational climate for innovation when the corporate management system changes. We conducted longitudinal action research from 2009 to 2013 in a Japanese manufacturing company consisting of 50 business units and approximately 8,000 employees. Knowledge co-creation among employees and power relationships between managers and followers are units of analysis in this study.

II. PERSPECTIVE, STRATEGY, AND METHOD

A. Perspective

Shirahada and Niwa [8-11] have advocated future focused management for motivating technical personnel. As they pointed out, it is difficult for managers to directly deal with and support subordinates' desires because their desires are too personal. They suggested that future-oriented mindsets/needs—the need to affect future society and to have a career that expands their future capabilities as technical personnel—strongly affect their work motivation [8-10]. Therefore, managers should focus on aspirations and visions based on their subordinates' own desires in order to manage their technical personnel effectively.

The performance model in Fig. 1 is based on these considerations [11]. It is aimed at practical applications and consists of five factors: vision, motivation, ideas, actions, and feelings of success. Vision represents a worker's future-oriented mindset (i.e., the impact the worker will have on future society) and is based on a subordinate's needs and desires. Motivation is the drive that determines the worker's level of effort toward his or her goals. Ideas represent the eagerness the worker has in generating ideas to achieve his or her goals. Actions represent the effort the worker expends in achieving his or her goals and the company's goals. Feelings of success represent the positive feelings the worker has due to feedback, their own development capabilities, and company growth.

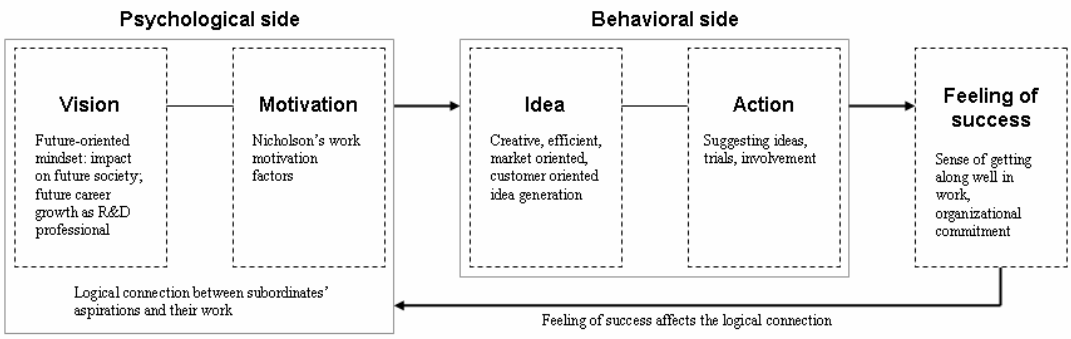

Fig. 1 Five-factor performance model [11]

B. Communication strategy

When headquarters sets the company vision, they will try to disseminate it efficiently. Thus, we developed an operation log information management system, which we call a monitoring system. This is able to report employee's activities to the managers with responsibility for maintaining security. When the managers receive the reports, they check the logs and make the line managers in their business units improve subordinates' compliance with the rules. In this model, workers are expected to improve autonomously on the basis of rules and information. However, they do not improve fast enough to satisfy business demands. It implies that middle managers in headquarters needed to promote organizational learning. Therefore we paid attention to the things that middle managers have to behave as a servant leader [7] to encourage employees, not as a spokesman of authority.

We considered an improvement strategy that focuses on goal setting and behavior. Workers consider the present situation and plan their next action. Thus, they should be motivated to act on their own initiative to achieve the goals toward realizing the company vision. Therefore, we made a communication tool incorporating the principal benefits of future focused motivation management into the communication between headquarters and business units. The tool is made of a 2X2 matrix chart called a communication sheet that consists of Results and Process, Review of Results, and Action plan, as shown in Fig. 2.

According to the five-factor performance model, the desired management style can be explained using the communication sheet. Regarding Feelings of Success, a T-Leader (a leader in a business unit) evaluates the results of this month's trial and error. Regarding Vision, the H-Leader (the leader at the headquarters) repeatedly explains the shared vision and the company's goal to all team members. The T-Leaders should motivate the employees by making them aware of the company's vision. The H-Leader needs the T-Leaders to think about the next month's plan from a future point of view. The T-Leaders set the department level goals creatively and autonomously. The aim is to share the goal image between headquarters and business units. Regarding Idea, the T-Leaders think of a way to realize the goal image. Regarding Action, they determine their strategy to support the technical personnel in their departments. This cycle should be repeated monthly, so that the technical personnel may change their behavior gradually. In addition to this mechanism, a future-goal-oriented coaching style model has another key factor, which is coaching style communication restricted to e-mail.

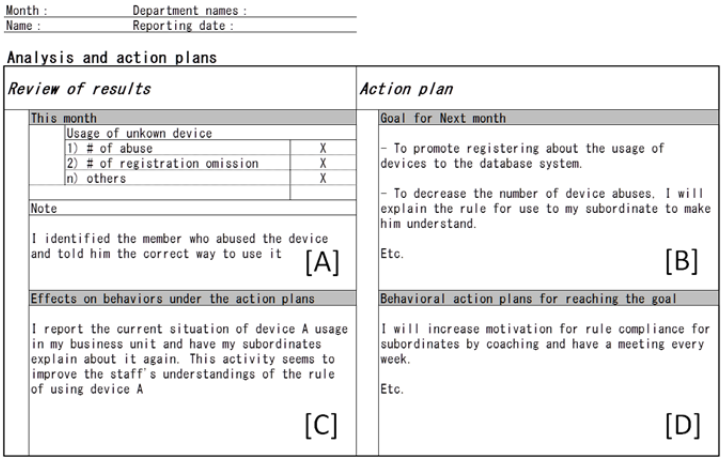

Fig. 2 Communication sheet including example of usage

C. Research method

We chose an action research method that seems to fit Stringer's action research model [12-13]. We conducted an action research to test research perspectives. Since we need to observe the dynamic changes occurring in actual businesses and build an action-based theory applicable to real management, we conducted an investigation using an action research method that is required for industrial and academic collaboration. The need for industry-academia research collaboration in the study of management is increasing because it can potentially solve cutting-edge problems in actual business and also to sow the seeds of new theories. However, traditionally, industry-academia research collaboration has been rather uncommon. In addition, university personnel seem to focus on applying existing theories to a field's problems rather than creating new knowledge through collaboration. To maximize the effects of the collaboration, joint research efforts require knowledge to be not only transferred but also generated. Brookes et al. [14] described that a basic action research framework has four research steps: Entry and Contracting, Diagnosis, Action, and Evaluation. Now, we explain the procedure with which we conducted action research in the technical organization of Japanese manufacturing company. This case may correspond to the technical collaborative approach in Holter & Schwartz-Barcott classification [15] and organizational action research in Hart & Bond classification [16].

We conducted a longitudinal action research from September 2009 to September 2013 to identify the effects of communication strategies between an autonomous business improvement model and future-goal-oriented coaching style model.

III. ACTION RESEARCH

A. Target organization

The field of this study is an organization consisting of the corporate headquarters and 50 technical business units. The initial state in Fig. 3 shows the organizational knowledge co-creation field between headquarters and business units. There are two types of Knowledge co-creation field. One is a horizontal KCC field for middle managers such as the leaders at headquarters and the business units. The other is vertical KCC field for leaders and technical personnel business units. In the initial state, the left side is the headquarters, led by the H-leader, and right side is the business units, led by the T-leaders. H-Leader aims to share corporate policies with business units. In each business unit, technical personnel and their managers must learn about corporate policies and adjust their behavior to reach their goals in accordance with the policies. Leaders in headquarters and business units communicate through e-mails. On the one hand, the H-Leader is one person, while on the other hand, T-Leaders are numerous people. In addition, T-Leaders are various distances away from the H-Leader. Therefore, the communication channel is restricted to e-mail.

They have faced an introduction of the internal regulations under the organizational improvement activity. Many people have no awareness to the regulations that must be obeyed at the first time.

B. Initial state in the organization

Since late 2009, the monitoring system has been in use. We can see a control index for each month illustrating whether technical personnel in business units keep to the rules or not. The basic steps of the KCC cycle are i) the monitoring system acquires information on behavior of technical personnel, ii) the information is analyzed to see if rules are followed, and the control index is calculated, iii) evaluation results are sent to leaders in monthly reports, iv) T-Leaders act to improve rule compliance in their departments, and v) the H-Leader and T-Leaders communicate to improve the next time.

The control index is calculated from operation logs by the following formula for each employee, department, business unit, and company: Control index (%) = the number of operations that do not comply with rules / the number of all operations.

In actual operations, several exceptions occurred, and the company policy permits some exceptions. Therefore, the control index retains a residual error, so it cannot reach zero. In practice, we are managing this control index to maintain certain safety standards made on the basis of experience at the work site. This index shows the degree of knowledge diffusion of an internal control policy.

The reports from the monitoring system enabled us to see the reality of employees' activities. The control index still remains approximately 84%. This means almost all employees need to be educated about company policy. This index may be decreased to a value close to 0%.

In the autonomous business improvement model, the H-Leader had requested T-Leaders by e-mail to provide the data of the control index and a list of people who need policy education. We also expected T-Leaders would educate their employees autonomously.

However, the rate of change in the control index (Fig. 4) was approximately 3% per month from September 2009 to July 2010. If the control index is extrapolated into the future, it will reach 0% in two years. If this situation continues, the goal will have taken three years to reach. This result is too late to achieve the business goals, so we should modify the strategy.

When a committee met in April 2010 to improve this situation, top management declared once again that rule compliance was the most important issue and extended the target completion date until December 2010. Learning from the experience of the unsatisfactory strategies, the H-Leader considered alternative strategies between May and July 2010. We were aware that the previous strategy could not motive T-Leaders to promote it.

Thus, we came up with the idea of T-Leaders sharing the company vision with all employees and sending feedback to

the H-Leader. Using the communication sheet and coaching over e-mail that aim to promote KCC. Then the H-Leader can promote his/her activity in KCC by using e-mail coaching.

In previous research of future focused motivation management [17], evaluations should focus on giving positive feedback so as to influence motivations of future behavior. In this way, this strategy has a built-in mechanism for promoting positive thinking, so that the workers can be motivated to achieve their own goals. Next, we apply the model using coaching style communication in e-mail.

C. Application of communication tool and its effects

After learning by trial and error, we found that workers actions come from their thoughts. Thus, we must focus on not only the results but also the thought-process. Therefore, we have devised methods for communication using coaching style, so the leaders communicated with each other by using the coaching style with the communication sheet as shown in Fig. 2 over e-mail. The communication channel is mostly e-mail because there numerous leaders who are far apart. Our future-goal-oriented coaching style model works as follows.

- In Field A, T-Leaders evaluate this month's results.
- In Field B, T-Leaders write the goal for next month.
- In Field C, T-Leaders evaluate the effects of behaviors under the action plans.
- In Field D, T-Leaders write the next behavioral action plans for the goal.

When thinking of Fields A to B, T-Leaders set their next goals to realize the shared vision defined by headquarters and agreed upon by other leaders. When thinking of Fields C to D, T-Leaders evaluate the previous plan and then plan further behavior changes. We expect their vision to become clear over the A-B-C-D cycle, so that their motivation to act increases. This e-mail based communication style can drive future focused motivation management [17] as follows.

T-Leaders act as follows with managers and employees. They create a co-evolution field together with managers to share the company vision (Vision). They come up with ideas for putting these ideas into practice (Idea). For example, they develop education tools and make actual procedures and standards. T-Leaders feel responsible for the result (Feeling of Success) and set a higher goal (Idea). For example, they try to fix a minor but difficult problem. They expand the co-evolution field by opening a dialog with personnel on-site. These activities then become habits.

After planning new strategies, we started using the improved communication style from August 2010 as shown in Fig. 4. Apparently, the rate of change in the control index improved to 10% per month for four months. If this trend had continued, the control index would have reached 0% in less than one year. This would have achieved the business goal. However, after the linearly decreasing period, the monthly improvement gradually decreased. Thus, at the deadline, the control index was about 16%. Furthermore, the control index continued decreasing and saturated near 5%. For business requirements, if this index kept near 5%, we could regard technical personnel as acting within the rules and further education would not be needed.

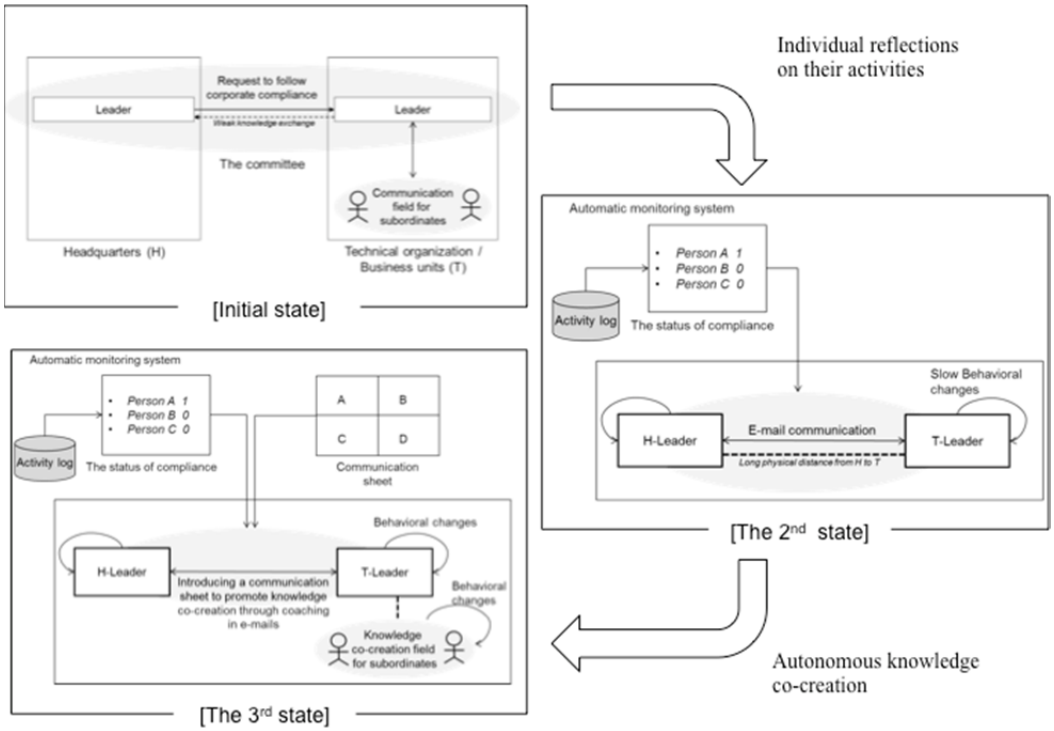

Fig.3 Knowledge co-creation of organizational states in action research

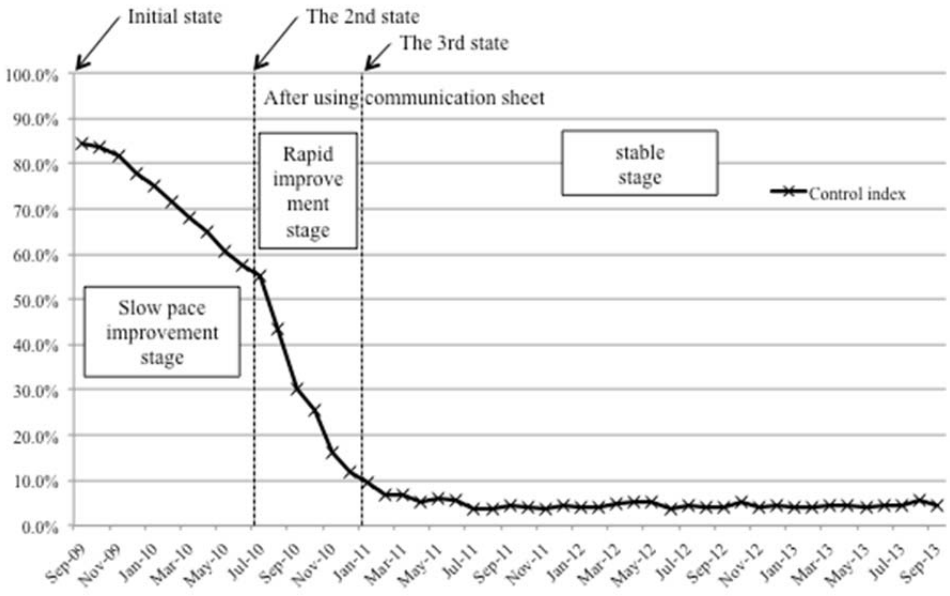

Fig.4 Transition of control index

IV. FINDINGS

As a result of action research, we found the following points for making an organizational climate where technical personnel can easily to act under limited autonomy.

First, the scheme of future focused motivation management [17] is applicable to technology organizations such as mid-sized manufacturing companies. It was also promoted by future-goal-oriented coaching style communication based on e-mail. We found that the employees in the organization who could understand the organization's vision and follow its rules can co-create new knowledge for innovation. We obtained data showing that before the way of KCC changed, the score was 3% per month, but after KCC changed, the rate was up to 10% per month. Therefore, we conclude a key factor of the increase (7% per month) is that future-focused motivation management with driven by future-goal-oriented coaching style communication based on e-mail.

Second, in addition to setting goals, headquarters need to communicate with managers in technology departments by setting several levels of goal images in a specific order: (i) corporate vision level, (ii) department level, (iii) individual level, and (iv) corporate level again. This procedure contributes technology personnel to promoting future-goal-oriented thought. Regarding (i), we found that it is important to provide such an attractive message that enables employees to think positively and feel like realizing future goal by accepting activities needed for realizing the vision. This brings positive feelings and raises self-esteem. Regarding (ii), we found that it is important to provide attractive message that makes employees feel confident they can achieve goals. Regarding (iii), we found that it is important to provide a strong message that enables employee to defeat obstacles to future goals. Regarding (iv), we found that it is important to provide such a strong message that enables employees to think positively and increase their self-esteem because they expect the visions to become reality. All this should be done repeatedly until it is habitual.

Third, we found the importance of preconditions for adjusting power balance between middle management and top management. This is because employees naturally want to be recognized by the boss under a pyramid-shaped corporate structure. Therefore, the boss should have a balanced attitude towards deciding which problems are important and should be solved. Middle managers are expected to exhibit leadership duaring these activities. Therefore, depending on an organization, some of the upper-management think about problem-solving as a task for subordinates rather than headquarters. In this case, middle managers often receive negetive feedback from subordinates and so have negative feelings. Therefore, headquarters must adjust managers' thoughts towards problems between headquarters and business units.

V. SUMMARY AND CONCLUSION

Technology organizations are required to both innovate and comply with their own rules. Technical personnel tend to make compliance with rules a lower priority than innovation because compliance with rules sometimes includes obstacles for developing new ideas. In this paper, we proposed a practical communication sheet based on the concept of future-oriented management to promote knowledge co-creation between headquarters (H) and technical organization / business units (T).

From our research, in-coming information is not sufficient to make the vertical KCC field work autonomously. The key

success factors in the e-mail coaching style model we developed are as follows. i) Leaders communicate their goal image to each other by using the communication sheet for future focused motivation management. ii) Leaders explain the future-goal-image by describing the company vision and business unit goals. iii) Upper-management delegates work in a way that employees can be motivated by doing important tasks. These key factors will contribute to enabling technical personnel not only to innovate but also to feel their technical knowledge is safe and secure.

From the point of view of enhancing their organizational capability, the improvement can be classified into three stages: i) slow pace improvement stage ii) rapid improvement stage iii) stable stage. Additionally we notice that the state transition will be irreversible, because of the third stage is stable without support of headquarters. Thus the organizational climate will be changed. As a future study, we need to test our method to larger number of companies based on employing more about academic theories. Regarding the way to application, our communication format and managers' leadership will become very important factors.

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