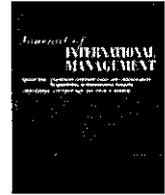




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Does cultural assimilation affect organizational decision-making on quality-related incidents? – A company's post-M&A experience

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ABSTRACT

Differences in organizational culture have been suggested as the major reason for the failure of mergers and acquisitions (M&A) to achieve synergies. We analyze an M&A case, focusing on the assimilation of organizational culture particularly with regard to quality. The purpose is to explore the consequences that internal inconsistencies in quality culture exert on quality performance, and to illustrate whether the assimilation of quality culture relates to organizational decision-making as corporate integration proceeds after a merger. We collect a unique data set that is not generally available, including internal quality data, customers' quality ratings, and records of quality-related incident resolution. A total of 301 incidents occurring during five years after a merger are analyzed by measuring the time taken to address the incidents and conducting a questionnaire survey followed by interviews. Further, a modeling study of the cultural assimilation process is conducted to establish a relationship between our theory and empirical findings. The results reveal that the efficiency of organizational decision-making is associated with the degree of cultural assimilation and how deeply into the layers of quality culture the assimilation extends. The findings suggest pragmatic implications as well as effective strategies managers could adopt for M&As and stimulate further research on corporate consolidations.

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1. Introduction

Corporate consolidations through mergers and acquisitions (M&A) are increasingly used as a primary growth strategy in today's competitive business environment (Arikawa and Miyajima, 2006; Cartwright and Schoenberg, 2006; Coeurdacier et al., 2009; Hijzen et al., 2006; Kurokawa, 2010). Although many M&As involve companies in the same country, cross-border M&As are becoming more common, recently reaching 40% of all M&As (Shimizu et al., 2004). The issues related to cross-border M&As are similar to those for domestic M&As. However, due to the different economic, institutional, and cultural structures affecting international consolidation, cross-border M&As present unique challenges (Hofstede, 1980; House et al., 2002). Even in domestic M&As, cross-border issues often arise when operations are located in different countries (Child et al., 2001). In a globalizing business environment, issues in cross-border M&As are thus becoming increasingly significant. In the present study, we discuss a cross-border issue focused on cultural assimilation in a company newly merged through a cross-border M&A.

M&A activities have been steadily increasing over the past two decades, yet few have been successful in achieving the synergies anticipated at their inception. Several studies have reported that more than half of M&As fail to meet expectations (de Camara and Renjen, 2004; Honore and Maheia, 2003; Mallette, 2003). Differences in organizational culture have been suggested as the major reason for the failure of M&A activities to effectively achieve synergies (Bligh, 2006; de Camara and Renjen, 2004; Forstmann, 1998). Various studies have pointed out that organizational culture affects corporate policies and contributes to corporate performance

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(Hirota et al., 2007; Kotter and Heskett, 1992; Pothukuchi et al., 2002; Sorensen, 2002). We assume that after a merger, internal inconsistencies in organizational culture influence various organizational decision-making processes, and as a result, affect the performance of a merged company. In this study, we view quality culture as one aspect of organizational culture that is related to the quality of products and services. Quality culture, then, specifically influences the quality of products and services. Fairfield-Sonn (2001), having the benefit of extensive corporate consulting experiences in the field of quality, asserted that for continuous quality improvement, accomplishing cultural change is even more important than applying tools and techniques. Many studies report similar experiences (Furrer et al., 2000; Lawrence and Kate, 2000; Lim, 1995; McNabb and Sepic, 1995; Nonaka and Nishi, 2007; Sinclair and Arthur, 1994).

Although examination of financial indices often dominates discussions of M&A results, the quality of products and services must be key in evaluating corporate performance. Therefore, this study's approach in which quality measures before and after a merger are compared and analyzed, should be an effective way to discuss the results of M&As. "Quality" is defined as the "degree to which a set of inherent characteristics fulfills requirements," in which "requirements" are understood to mean "needs or expectations that are stated, generally implied, or obligatory" (ISO9000, 2000). Requirements vary by customer and are not fixed over long periods of time. Therefore, when we measure quality before and after a merger, it is crucial to do so on the basis of objective data with sufficiently fine resolution. In this study, customer-supplied rankings were used to compare pre- and post-merger quality.

Even though there are many definitions of organizational culture, this study neither covers all attributes nor conducts direct measures of the scope generally understood from the term "organizational culture" or "quality culture." As the assumption of this study, we defined quality culture as explicitly divided into three hierarchical layers (levels 1, 2, and 3) by their visibility (ability to be observed), level 1 being the most visible. We then examined and analyzed the actual data measured in a specific case. Although the data were indirect measures of quality culture as defined herein, we also conducted a questionnaire survey and interviews to complement those measures, and finally we discussed the relationships between the process of cultural assimilation and organizational decision-making in corporate consolidations on the basis of these analyses. The term "cultural assimilation" in the context of this study means that two originally different cultures become one, i.e., either the same as one of the pre-assimilation cultures or different from both. In the case we consider, the quality culture gradually converges through the leadership of upper management and/or interaction among organization members.

The first purpose of the present study is to investigate whether the assimilation of quality culture relates to organizational decision-making in the process of corporate integration after a merger. The second purpose is to explore the consequences that internal inconsistencies in quality culture exert on a merged company's quality performance. Ultimately, the aim of this research is to suggest strategies for corporate management to adopt prior to executing M&A activities and to stimulate future case-study research in this field.

Analysis of transitions related to quality in corporate consolidations following M&As is limited primarily to the work of Lopes (2003). Whether the degree of assimilation of quality culture actually relates to organizational decision-making and results in changes in quality performance in a merged company is a question that remains unanswered. To answer these questions, in-depth investigations were conducted on a real firm (Company C), which was established several years ago as a result of a Japanese company (Company A) purchasing a division of a U.S. company (Company B), and merging it with its own corresponding division. With the consent of Company C, we were fortunately able to collect a unique data set that is not generally available, internal quality-related data, of which we made a detailed investigation. We then conducted a questionnaire survey and interviewed managers to verify the findings of the data analysis. We finally performed a modeling study of the cultural assimilation process by using agent-based simulation based on the foregoing survey and interviews, and attempted to fill the gap between our theory and the empirical findings.

To examine the efficiency of organizational decision-making in the merged company, we analyzed the process for resolving unexpected quality-related incidents, termed "quality incidents," and measured the time required to process them. In this study, "efficiency" is defined as the degree of being efficient (Webster's Third New International Dictionary), which is measured by the time required for the completion of the organizational activity concerned. All quality incidents during the first five years after the merger were analyzed. In these analyses, we focused on the difference between the time required for the process handled by a single functional section and that required for multiple functional sections' processing. The implications drawn by these analyses were that the degree of assimilation in quality culture levels 1 and 2 is associated with the efficiency of organizational decision-making when a single functional section is involved; however, if multiple functional sections are involved, the degree of assimilation in quality culture level 3 is also associated with its efficiency. Our modeling study results also reinforced the findings with a simulation approach. These findings must be interpreted carefully because the analyses were not intended to show causality and are based on a single case. However, we observed in this case that the assimilation of quality culture certainly relates to the efficiency of organizational decision-making.

The discussion in Section 2 includes a survey of the literature on approaches to organizational culture and existing research on the results of M&As. This background enables us to define the term "quality culture," the three-layer model of quality culture, and understand the assimilation of quality culture. We then outline our method, present our findings and our modeling study, and conclude with a discussion of the results and their implications for research and practice.

2. Organizational culture and quality culture

2.1. Approaches to organizational culture

Two different approaches to understanding organizational culture have been established. One is a functionalistic approach that views organizational culture as one variable in an organization (e.g., Schein, 1983). In this approach, organizational culture

influences the behavior and performance of members, and can become either a means or an object of management. The leader of the organization has the power to create, influence, or revolutionize organizational culture (Deguchi, 2004; Sakashita, 2002; Smircich, 1983; Tanaka, 2006).

The other is an interpretative approach, in which organizational culture becomes a metaphor for the organization itself: culture, rather than being a separate attribute of the organization, is equivalent to the members of the organization who create the culture through mutual interaction (e.g., Gregory, 1983). Consequently, the leader of the organization is considered to be unable to create or change organizational culture, and making organizational culture an object of management is generally difficult when viewed in this way (Deguchi, 2004; Sakashita, 2002; Smircich, 1983; Tanaka, 2006).

We take the position, based on our personal experience, that organizational culture can be changed through a combination of the leadership of management and interaction among organization members.

2.2. Three-layer model of quality culture and cultural inertia

Schein (1985) defines organizational culture by focusing on the beliefs, values, and assumptions generally shared by organization members, and divides cultural elements into three levels based on their visibility. Level 1, the most visible level, comprises "Artifacts and Creations," such as the physical design of the office, logos, products, organizations, processes, and members' attire, behavior, and language. Although it is easy to observe level 1, it is necessary to understand level 2, "Values," to understand the full meaning of level 1 and the interrelation between levels 1 and 2. Level 2 comprises values, norms, and principles shared by organization members. When a solution process succeeds repeatedly, its value becomes ingrained in the culture until it finally becomes accepted as the de facto response or behavior. This valuation eventually progresses to level 3, "Basic Assumptions." At this level, assumptions are not questioned or challenged, but actually guide members' perceptions, thoughts, and feelings about various topics. Level 3 is considered to be the essence of organizational culture. As previously outlined, quality culture, as one aspect of organizational culture, can also be divided into three hierarchical layers by visibility. Fig. 1 illustrates the three-layer model of quality culture. In addition, we define "cultural inertia" at each level, which reflects the degree of inconstancy, because organizational culture could be changed to adapt to environmental changes such as M&As. Miles and Snow (1978) revealed that when a high level of consistency was established in an organization, even if environmental changes occurred, the adaptive process was less likely to occur to maintain the consistency for its own sake. Since then, various studies have also discussed cultural inertia with that same concept (Carrillo and Gromb, 2007; Kagono, 1987; Tushman and O'Reilly, 1996; Weber and Camerer, 2003). Cultural inertia in this study relies on this concept.

For the purposes of this study, level 1 is called the "Quality System," which is composed of quality-related organizational structures, processes, and specifications. For example, as products' quality data are observable results of specifications, it should be categorized as level 1. In the context of cultural assimilation after a merger, the activities that two organizations from Companies A and B are integrated into a single organization, two different processes are consolidated into a common process, and two similar but un-identical specifications are standardized, are intended for level 1 assimilation. Given the nature of corporate management, a management can change level 1 when necessary and the cultural inertia of level 1 is considered to be low. Level 2 is "Common Quality Values," the organization's values with respect to quality, which are articulated as operational norms and guidelines for quality-related situations and incentive plans for quality achievements. For level 2 assimilation in a newly merged company, most members probably need to adapt to new values. Further, level 2 is not necessarily made fully visible as explicit knowledge such as through rules and manuals. Therefore, sufficient time is required for level 2 assimilation, even after level 1 assimilation, and level 2's cultural inertia is greater than that of level 1. Level 3, "Base-level Quality Principles," comprises implicit assumptions that determine the decision-making approach. With the lowest visibility, level 3 assimilation requires long-term learning through member interaction and/or top-down leadership. This level's cultural inertia is obviously greater than level 2's. When quality culture is discussed in the context of corporate consolidations, it is crucial to analyze levels 2 and 3 in-depth.

When differences in organizational culture are observed between companies in different countries, the national culture's contribution to those differences should also be considered. National culture is the set of behaviors and beliefs common to individuals living in a particular country, and it is influenced by the country's history, politics, economy, and social system (Hofstede, 1980;

Quality Culture (Corporate Culture by Schein)	Level 1 (Artifacts and Creations) Quality System: organization, processes, specifications
	Level 2 (Values) Common Quality Values: operational norms and guidelines, incentive plans
	Level 3 (Basic Assumptions) Base-level Quality Principles: unconscious assumptions upon which quality culture is based

Fig. 1. Three-layer model of corporate and quality culture.
Source: Made by the author after Schein (1985).

Newman and Nollen, 1996). Hofstede (1980) and House et al. (2004) conducted large-scale comparison studies on cultural values in a variety of countries. Both studies concluded that a large disparity in national culture is apparent between Japan and the U.S. Although certain researchers define national and organizational cultures as separate constructs, others agree that these two constructs are interrelated and strongly influence each other (Malekzadeh and Nahavandi, 1998; van Oudenhoven, 2001). We inferred that differences in national culture inevitably influence organizational culture; thus, a great degree of cultural friction is expected in mergers involving companies from these two countries. It is, however, difficult to identify which elements of organizational culture result from national culture in a specific case. Therefore, in this study, we focus on organizational culture that subsumed national culture as the foundation of organizational members' personal values, which are captured as the strength of cultural dimensions such as power distance, individualism vs. collectivism, uncertainty avoidance, and masculinity vs. femininity (Hofstede, 1980). In the process of cultural assimilation, the magnitude of cultural inertia represents the degree of cultural differences between two companies, and we assume that the cultural inertia, particularly on levels 2 and 3, in cross-border M&As involving companies with very different national cultures would be greater than in domestic M&As.

2.3. Existing research on the influence of cultural differences after M&As

Several recent studies have performed meta-analyses of previous M&A research. Shimizu et al. (2004) examined research findings in 36 studies on cross-border M&As, and concluded that gaps remained to be addressed. They highlighted important research areas that provide directions for future research, including learning from successful and failed M&As – which would open the “black box” and provide managerial insights on mistakes and failures, and thus significantly benefit scholarly research. Stahl and Voigt (2008) conducted a meta-analysis of 46 studies, with a combined sample size of 10,710 M&As. They analyzed both positive and negative influences of cultural differences on corporate performance, concluding that the effect was inconsistent because the outcome depended on a number of contingencies, including the degree of similarity and the dimensions of cultural differences separating the merging companies. Finally, they suggested that future research should be directed towards M&A integration, particularly into how cultural differences affect the integration process and what can be done to manage these differences more effectively. These meta-analyses commonly indicate that in-depth investigations of the integration process in specific cases, such as we attempt here, are to be desired in future M&A research.

Although there have been a number of studies and numerous research efforts on the subject of cultural differences in M&As, little attention has been given to dependent variables such as product quality, market share, and the speed of internal decision-making. Lopes (2003) evaluated recent M&As in the U.S., focusing on the influence of organizational culture on product quality, company reputation, and market share. Declines in the reputations of both companies as perceived by customers and declining market shares were associated with changes in organizational culture, although no overall trends in quality could be established. Lopes (2003) did not touch on the relationship that these factors have with internal decision-making.

In this study, we examine the assimilation process of a specific M&A case from the perspective of quality culture and analyze the efficiency of organizational decision-making in resolving quality incidents. Ito et al. (2010) took a similar approach. They analyzed the data of Company C and concluded that the degree of cultural assimilation was associated with the time taken for organizational decision-making after the corporate consolidation. In their study, the degree of cultural assimilation was viewed comprehensively and cross-sectionally, disregarding individual layers of culture and separate organizations. However, cultural assimilation does not proceed at the same pace on each layer of culture and can also differ across organizations; further, the time taken for organizational decision-making probably depends on the range of organizations involved in such decision-making. In the present study, we define quality culture as a three-layer model with levels 1, 2, and 3, as described above, and classify organizational decision-making into two types on the basis of the number of functional sections involved: cases in which a single functional section is involved and those in which multiple functional sections are involved. By conducting this further investigation and analysis of Company C, this study elucidates the relationship between the degree of each layer's cultural assimilation and the efficiency of organizational decision-making in each type. Thus, this study makes the following theoretical contribution with empirical data verification. We find that the degree of cultural assimilation in level 2, the middle layer, is associated with organizational decision-making efficiency in a single functional section, and the degree of cultural assimilation in level 3, the deepest layer, is associated with organizational decision-making efficiency across multiple functional sections.

3. Method

As previously shown, few existing research has analyzed the integration process to address the issue of how cultural transition affects the performance of merged companies. When discussing strategies that corporate management should adopt prior to launching corporate consolidations through M&As, it would be valuable to determine which factors in a specific case were related to the efficiency of internal processes and how the processes progressed over the duration of the integration. The present study explores research questions by analyzing a specific case to provide suggestions for management of corporate consolidations, and to stimulate future case-study research that opens the “black box” of the M&A integration process.

The example used in a case study must be recognized as typical and the researcher must obtain the consent of the company being investigated to analyze its data and announce the findings. Company C was chosen because it fits both these conditions. This study is therefore based primarily on the analysis of data as agreed to by Company C. More than 24,000 employees were merged into Company C from the divisions of Companies A and B in a ratio of 1:3. All the functional resources needed for a new company were integrated into Company C from both divisions. All the products, intellectual properties, and business contracts concerned

were transferred to Company C. Thus, Company C was an independent entity, organizationally and in practice, and it was considered that few cultural effects had been derived from either Company A or B after launching Company C, although both parent companies continued as separate entities. Both divisions had been in the product field for over 40 years. Before the merger, both divisions had a similar line of products, their customer base was almost identical, and thus they had been competing against each other in the same market environment. The size of this market had been steadily expanding, and competition against several other suppliers had been intensifying. In addition, the reputation of both divisions' products was stable and well established. However, Companies A and B obviously had different organizational cultures, as represented by their different official languages such as Japanese and English. Thus, Company C is an appropriate case to use for an analysis of cultural assimilation.

In the present study, we took a three-step approach. The first was to analyze Company C's quality-related data gathered over the first five years after the merger. The second was a questionnaire survey and interviews of Company C's managers. The third was a modeling study of the cultural assimilation process. Each method is described below.

3.1. Investigation of Company C data

This study analyzed two types of data on Company C. One was data on the quality performance of products and services, including customers' quality rankings and quality criteria, and Company C's recorded quantitative quality data on product shipments. As previously mentioned, with quality defined as the degree to which needs or expectations of customers are fulfilled, using customer feedback is the most appropriate way to assess quality. Therefore, we focused on quality rankings provided in customers' quarterly business reviews to analyze the evolution of quality in Company C. Company C specializes in electronic equipment used in system products that their clients manufacture. The majority of sales are business to business (B2B), and most customers hold quarterly business reviews with each key supplier, during which the customer and supplier discuss the supplier's performance in the previous term and the business plan for the next. The customer evaluates the supplier's performance on quality, technology, price, and supply, and provides rankings in each category for all suppliers, from whom they purchase equivalent products. The customer evaluations are called quarterly business reviews scores and rankings. The quality rankings are generally the most significant element because they are likely to affect the proportion of products purchased from the supplier in the following terms. We examined the quality rankings for the five years after the merger and compared them with internal quality data during the same period. The quality data represent the quantitative indicator of product quality, including the number of Company C product failure occurrences at customer sites.

The other data type concerned processes for resolving quality incidents. This included QA bulletins that listed each quality incident and the status of action plans to address the quality incident, and weekly QA reports that tracked the progress of countermeasures until each quality incident was resolved. Thus, we were able to measure the time required to resolve each quality incident by analyzing Company C's archives of QA bulletins and reports. Since quality incidents were unexpected events, countermeasures could not be pre-determined unless an identical phenomenon had previously occurred. Most quality incidents were new events. When a quality incident occurred, therefore, irregular or non-routine decision-making was generally required to effectively address it. For example, even if the product quality had been stable and a product was performing well in field operations for a period, potential problems such as firmware bugs can surface unexpectedly when software for customers' products is updated or when the customer's built-in processes are modified, and a large amount of trouble occurs. To address such quality incidents, several steps must be taken, such as investigation and location of the cause, examination and determination of countermeasures, the development, evaluation, and verification of firmware design changes, and the implementation of those measures, including changes in procurement, production, and supply chain operation, as well as supporting customers as they adopt the changes. A number of functional sections, including quality assurance (QA), design engineering, production, customer support, and others as needed must be involved to address quality incidents in the process of resolving them (hereafter called "quality incident process"). Further, each section must make resource allocation decisions to adjust their daily routines to respond to such unplanned events. Thus, analyzing the quality incident process is an appropriate method for evaluating Company C's organizational ability to respond to contingencies. The quality incident process comprises the series of measures taken to address a quality incident from its occurrence to its final resolution, with the customers' consent, and the time of the quality incident process represents the time duration from its occurrence to its resolution. We considered two methods of measuring the time of the quality incident process, these are "time required to issue QA bulletins" and "time required to resolve quality incidents." All quality incident records covering the five years following the merger were investigated to assess the two time measurements.

3.2. Questionnaire survey and interviews

We conducted a questionnaire survey in a local subsidiary of Company C in Japan, particularly for the management who had continued working even after the merger. Of 710 applicable respondents, a total of 100 were randomly extracted, of which 50 were originally from Company A (hereafter called "ex-A") and 50 from Company B (hereafter called "ex-B"). The reasons for choosing this target were as follows. First, we wanted to avoid the influence of the differences in national culture insofar as possible; in fact, all respondents were Japanese nationals. Nevertheless, as a result of random sampling, we could expect to see the clear differences in organizational culture between Companies A and B. Second, the organization covered all relevant functions we were targeting although it was a local subsidiary company. The survey was conducted in March 2009, and respondents replied directly to us in anonymity on a website designated for the questionnaire. To minimize bias in the responses, the survey questions were composed of yes/no and multiple-choice questions. It assessed (1) whether respondents had felt cultural differences in those who were from

the partner company at Company C's launch, (2) whether they had recognized that current organizational culture had changed into an assimilated one, and (3) if the organizational culture had already changed, from the respondents' perspective, which factor would propel cultural change — member interaction or top-down leadership. The number of valid responses was 67; 33 were ex-A and 34 were ex-B, and in average the respondents' length of service was 16.1 years; thus the sampling error was $\pm 5.7\%$ for the answer ratio 90%–10% and $\pm 9.6\%$ for the answer ratio 50%–50% (at 90% reliability).

We then conducted personal interviews with several functional section managers. The interviewees who satisfied the following conditions were chosen: First, he or she had to be a functional section manager since the answers would be based on his or her section. Second, the interviewee must have had more than 10 years of continued service with either Companies A and C or B and C, to ensure that the answers were supported by experience gained during the post-merger integration (PMI) phase. Third, the interviewees included both ex-A and ex-B employees. Fourth, interviewees from QA, customer support, and design engineering were chosen because those functions were expected to contribute as major players in the quality incident process. The seven people who agreed to be interviewed were (1) QA manager for product A in ex-B, Japan; (2) design engineering manager for product A in ex-B, Japan; (3) design engineering manager for product B in ex-A, Japan; (4) QA manager for product B in ex-A, Japan; (5) QA manager for product C in ex-B, U.S.; (6) customer support manager in ex-B, U.S.; and (7) design engineering manager for product D in ex-A, Japan. Semi-structured in-depth interviews were conducted in October 2009 in the U.S., and in August 2010, February 2011, and July 2011 in Japan. Respondents (1, 4, and 7) were interviewed more than twice, and each interview lasted from 1 to 1.5 hours. To reach a common understanding about "Quality Culture," the definition of the term and its three-layer model in this study were explained to each respondent at the beginning of each interview. The main section of the interview included questions about the quality culture and the quality incident process, such as how the respondent was involved with quality incidents, what differences he or she perceived in quality culture during quality incident episodes, and how the quality incident process had changed after the merger. It also included questions concerning organizational decision-making events during the PMI phase and five years after the merger. At the end of the interviews, respondents were asked their views on the findings of our data analysis.

3.3. Modeling study of the cultural assimilation process

Simulation modeling is an increasingly significant methodology for advancing theory and research focused on organizational behaviors (Davis et al., 2007; Harrison et al., 2007; Terano, 2008). To make a linkage between our theory of cultural assimilation and the empirical findings through analyzing Company C's data, we developed a simple dynamic simulation model of the cultural assimilation process by using agent-based modeling. It focuses on modeling the behaviors of adaptive agents, that is, organization members who influence one another through their interactions (Macy and Willer, 2002). From our perspective, which had been supported by the interviews with Company C's managers, when organization members participate in organizational decision-making, the participants not only interact with each other but also acquire certain directives from higher management, making both strong motivators of change in cultural traits. Therefore, we attempted to extend Axelrod's (1997a, 1997b) disseminating culture model by adding the effect of top-down actions upon the members. The simulator tool we used was ARTISOC (Kozo Keikaku Engineering, 2010; Yamakage, 2007). We then conducted experiments in the most likely condition of Company C. Simulation parameters required by the model, such as the number of members, the number of organizational decision-making events in which members participate, and the degree of members' intention for adopting the top-down or other members' culture, were determined on the basis of the Company C data and/or the results of the foregoing questionnaire survey.

4. Results

Through our analysis of Company C's data, we found that the prolongation of resolving quality incidents caused by internal inconsistencies in quality culture was a dominant factor in the significant decline in customers' quality rankings in the first year after the merger. In the second year, the quality rankings began to recover, and in the third year, they neared the pre-merger level. We also attribute this recovery to quality culture assimilation, which remedied the decline in quality rankings, according to our analysis in this section. We then proceed to explore the quality incident process, as we recognize the inevitable relationship between the quality rankings and the time required for resolving quality incidents.

The time required for the quality incident process had been shortened and stabilized after a certain period post-merger. This was generally expected because every process was supposed to be improved after the merger. However, comparing the process handled by a single functional section to that requiring the involvement of multiple functional sections, revealed significant differences in both the periods until stability was reached and the course of evolution. In the one-function process, the time decreased rapidly and immediately after the merger, but stabilized in about one year; whereas for the multi-function process, the time actually increased in the first year, began to decrease in the second year, and stabilized in the third year after the merger. The analysis also suggested that the degree of assimilation at quality culture levels 1 and 2 was associated with the efficiency of single-function processes, whereas the degree of assimilation in the deepest quality culture layer, level 3, was associated with the efficiency of multi-function processes.

In summary, respondents' answers supported the result of our analysis. All 67 respondents in the questionnaire survey and the seven interviewees reported having felt obvious differences in the partners' organizational cultures at Company C's launch. QA manager (1) gave the following example: "The approach of how to deal with problems of products in the development phase was a primary difference. One side first assessed the risk of an occurrence, while the other side gave priority to pursuing causes and preventing recurrences." Another QA manager (4) stated, "The organizations' structures and processes were totally different.

Their way of thinking about the roles and responsibilities of the QA function was far different from ours." Design engineering manager (2) said, "When we tried to boldly take on new challenges, there was a difference in how conservative the two sides were in taking quality risks." Moreover, six of the seven interviewees reported that resolving quality incidents took longer after the merger. QA manager (1) stated, "Because of the differences in common quality value among members, we spent a lot of time not only pursuing the cause of quality incidents, but also designating responsible members for corrective actions." Regarding the question of when they felt that the organizational culture had been assimilated in Company C, 57 respondents out of 67 (85%) in the questionnaire survey answered that it had already been achieved: 24 (36%) answered it occurred in the third year after the merger, 14 (21%) in the fifth year or later, 7 (10%) in the first year, 6 (9%) in the second year, 6 (9%) in the fourth year, and 10 (15%) responded that it had not yet occurred. That is, 43 (64%) respondents felt that the cultural assimilation in Company C had been achieved between the first and fourth years after the merger, with the greatest number selecting the third year. All the interviewees indicated that if the members involved in the quality incident process shared the deepest layer of quality culture, the efficiency of the quality incident process improves greatly. QA manager (5) said, "Most important is that we operate as one company in terms of quality mind. If we have cultural differences or do not share core company values, technical problems are more difficult. We need a foundation as a company before we tackle technical elements in detail." Two respondents (1 and 6) mentioned coordination between functional sections on quality incidents, stating that QA and design engineering always struggle with prioritizing problems and allocating the necessary time to settle them. At the end of the interviews, when asked about our findings from the case analysis, all respondents except one stated that the results were quite understandable and reasonable, although design engineering manager (3) stated, "From my perspective, since there was more difference between individuals than between the organizations, I could not say whether the quality culture has been assimilated in the whole company and influenced the efficiency of quality incident process."

Using our simulation model of the cultural assimilation process, we conducted computational experiments throughout the entire integration period of Company C with parameters based on the data and the interviews with its managers. In the simulation, we defined the "cultural index for decision-making" as an indicator, which depends on the degree of similarity of the cultural traits (cultural similarity) among members who had participated in organizational decision-making. The result of the experiments demonstrated that the cultural index for decision-making by the simulation result and the actual transition data of the time required for resolving quality incidents were closely compatible. Thus, we believe that the simulation result supports our findings and makes a linkage between our theory and the empirical findings. The simulation model and results are presented in detail in Section 4.3 and its subsections.

In summary, our general findings emphasize the importance of the degree of assimilation in the deeper layers of quality culture that relates to organizational decision-making efficiency and a merged company's quality performance. The details of our results follow.

4.1. Evolution of quality after merger

Customers' quality rankings based on their assessment of Company C's performance decreased suddenly after the merger. Fig. 2 shows changes in quality rankings (average of eight major customers) reported to Company C in quarterly business reviews during the transition.

The data shown for before the merger is from Company A's records and from Company B's estimated data, provided by customer support manager (6), as there were no ranking data recorded by Company B. These customers generally had three to five different alternative suppliers, and thus the range of the quality rankings was from 1 (first place) to 5 (fifth place), and ranking at 3 (third place) or lower was considered to be nearly the lowest among designated suppliers. The target ranking for Company C was 1 or 2.

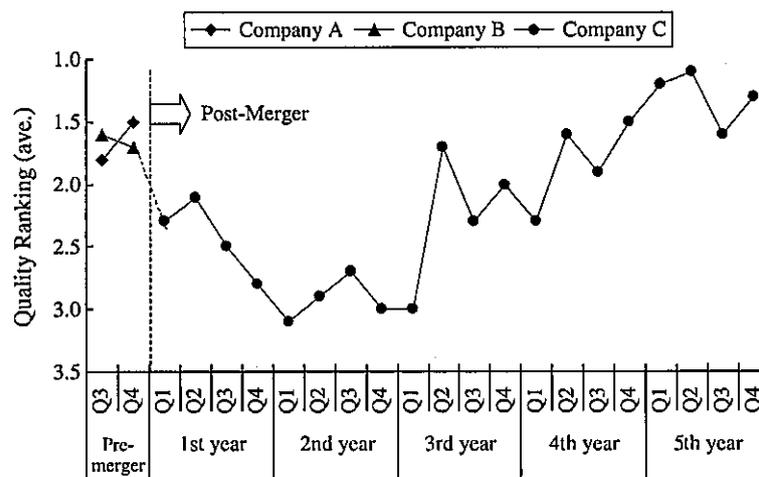


Fig. 2. Quality rankings from quarterly business reviews. Note: The standard deviation of Quality Rankings: 0.35–1.17.

Immediately after the M&A contract was executed, the PMI project in which the two organizations were integrated and combined into a single organization was conducted until Company C was officially launched. In this project, naturally, the first priority was given to the integration of the “quality system,” quality culture level 1, and that had been accomplished by the first official day of Company C’s operation. However, the product lineups and customer support systems were unchanged to avoid any inconvenience to customers when business shifted to Company C from Companies A and B. Further, the executive management team of Company C comprised a combination of ex-A and ex-B personnel, and took a course toward developing a unique blend of Companies A and B for industry best practices rather than the previous practices of either Company A or B. As shown in Fig. 2, however, the customers’ evaluations of quality dropped suddenly after the merger, and then recovered by the end of the third post-merger year. Since quality rankings are measured relative to competitors, comparative increases or decreases in the quality ratings of other suppliers could have caused variations in Company C’s rank. If that was the case, significant changes of more than 1.0 in the average rank, such as the series of declines in the first year and the sharp recovery in the third year after the merger, might have been caused by more than two competitors’ impacts at those times. However, interview respondents (1 and 4), who were in positions where they could obtain quality information even on competitors, stated that they had observed no remarkable changes in competitors’ quality-related attributes over that period that could have caused Company C to experience such changes in its rankings. Thus, we inferred that these significant changes appear to be the result of the customers’ assessments of Company C’s performance itself. To clarify the cause of these changes, Company C’s quality-related data and customers’ quality criteria were investigated and analyzed as follows.

4.1.1. Transition data on the quality of shipped products and the number of quality incidents

In this paper, we refer to the quality of products when they are shipped to customers as “shipment quality.” Fig. 3 shows the change in the shipment quality of products along with the number of quality incidents after the merger. In shipment quality, three categories of Company C’s products, such as Product A carried over from Company A, Product B carried over from Company B, and Product C developed by Company C after the merger as follow on products, were plotted in this figure.

The shipment quality is defined by the number of defective units detected within 90 days after shipment. The values in Fig. 3 are based on an index in which 100 is Company A’s rate just before the merger. The shipment quality of both Products A and B immediately after the merger were almost equivalent. No deterioration was observed, but rather a tendency toward improvement as shown in Fig. 3. Further, the shipment quality of Product C has shown a steady improvement trend ever since. Consequently, we cannot conclude that sudden changes in quality rankings such as the series of declines in the first year and the sharp recovery in the third year were caused by the shipment quality of products delivered by Company C.

Although the shipment quality was stable, the occurrence of quality incidents having to do with products previously delivered might affect Company C’s quality rating. The events of quality incidents reported was supposed to cover all quality-related incidents of not only newly shipped products by Company C but also legacy products delivered in the past by either Company A or B prior to the merger and were still in field operations. Fig. 3 shows the transition of the number of quality incidents as well. In the figure, the quality incidents are divided into two groups: cases detected internally by Company C and cases that occurred at customers’ sites, which impact the clients more than internally detected cases. Comparing the first and third years, revealed that there were more quality incidents of both types in the third year than in the first year, although the quality rankings were decreasing in the first year and

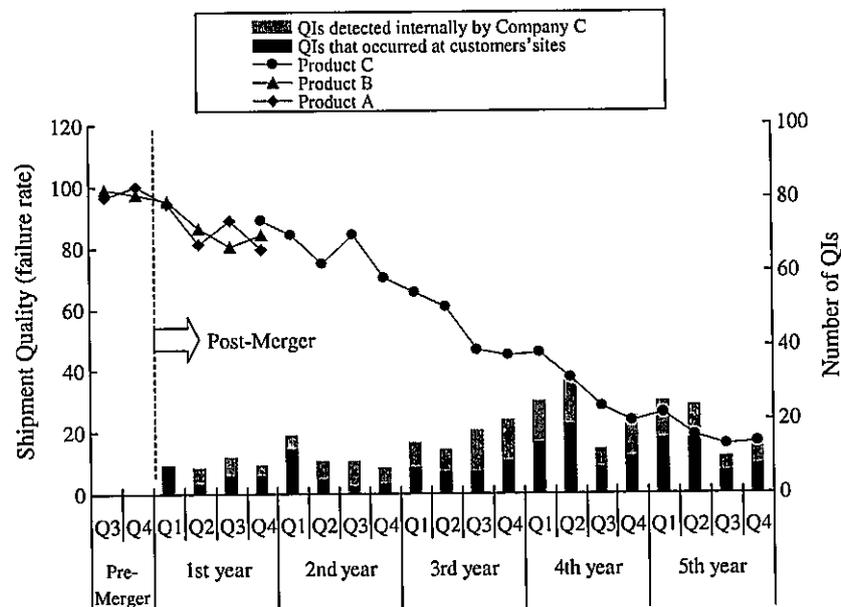


Fig. 3. Shipment quality and the number of quality incidents.

increasing in the third. Thus, the number of quality incidents does not seem to have caused the sudden changes in quality rankings. Even if the number of quality incidents was small, one quality incident might have a destructive impact on customers. However, QA manager (4) stated, "We never experienced any catastrophic quality incidents in the first year after the merger, although the quality rankings declined suddenly." Thus, the preconception that the occurrence of quality incidents had a direct correlation with customers' quality ratings was not supported by this analysis. Although the number of quality incidents was increasing in the third year, the proportion of cases detected internally was increasing among all quality incidents, such as from 36% in the first year to 56% in the third year. This could be a sign of the coalescing of Company C's quality culture. Although the number of Company C's product shipments had increased even in the first and second years, due to increased market growth, Company C's market share decreased continuously over that period, falling to nearly half of its initial value by the middle of the third year and remaining largely stable thereafter, with a few episodes of slight improvement. We assumed that the sharp decline in the quality rankings appears to be related to the decline in market share. As described above, both the shipment quality and the occurrence of quality incidents were not considered to be the causes of significant changes in Company C's quality rankings, and thus we had to pursue another factor causing the decline.

4.1.2. Quality criteria that determined customers' quality rankings

We then investigated the quality criteria on which customers evaluated Company C's performance. Fig. 4 shows the distribution of quality criteria weighting assigned by customers to the two measures: quality data and quality-related items.

Although the criteria on which the customers based their evaluations were quite similar, each customer specified the scoring rules and weighted the criteria differently based on their strategy for working with suppliers. The figure shows how five major customers (a, b, c, d, and e) weighted their quality evaluations. Together, these customers comprised approximately half the market for the product, and customer (a) was the highest volume customer then. Quality rankings were determined by the total score for quality data and quality-related items multiplied by each criterion's corresponding weighting. Here, quality data included customer integration quality and field operation quality, which were quantitative, objective measures related to quality culture level 1 as previously defined. Customer integration quality was a measure of the number of failures detected during the built-in process on the customer side and represented shipment quality. Field operation quality was a measure of the number of failures in customers' products during field operations. If customer integration quality and/or field operation quality suddenly changed, exceeding a specified control limit, a quality incident had to be triggered to address the situation. Quality-related items, such as speed and contribution in addressing quality incidents were non-quantitative measures based on customers' perceptions. Customers mentioned in quarterly business reviews, according to customer support manager (6), that the score of quality-related items depended primarily on actions and behaviors of those who supported them on quality incidents. As previously defined, common quality value, such as operational norms and guidelines, and base-level quality principles as implicit assumptions determine organization members' actions and behaviors. Thus, quality-related items are considered to be related to quality culture levels 2 and 3. As shown in Fig. 4, it is evident that more than one-third of the quality rating was based on quality-related items. To understand why the quality rankings dropped immediately after the merger, both quality data and quality-related items need to be examined. QA manager (4) stated, "We had been competing intensely with competitors to get better quality scores, even a few in those days, but the pace of improvements was not fast, but rather step by step for every supplier." Customer support manager (6) also made the following observation. "From my perspective, most of the rankings are not reflective of actual product quality, but are more customers' perceptions. For customers, it is just a way to communicate if they are happy or not happy with us." From such evidences, we inferred that because the differences among the scores of quality data were rather small, even though its weight was larger than quality-related items' for most customers, the scores of quality-related items had become a dominant determinant of quality rankings among designated suppliers. Therefore, significant changes in the quality rankings were likely caused by decreasing scores of quality-related items.

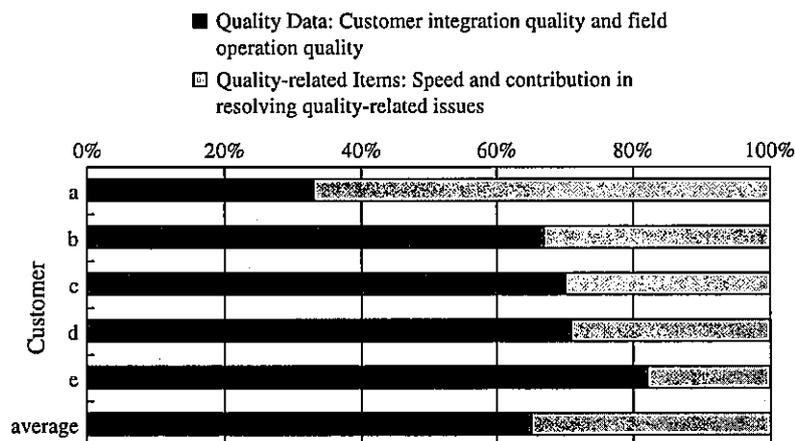


Fig. 4. Weighting distribution in quality criteria.

4.1.3. Leading causes of customers' quality ranking changes

Evidences offered in the early part of this section, demonstrate that internal inconsistencies in quality culture existed at the early stage of Company C on the basis of the results of a questionnaire survey and interviews with Company C managers. In addition, at quarterly business reviews during the first years after the merger, customers made the following comments, collected by one of Company C's customer support managers who attended the meetings:

- 1) "Responses and actions were slow compared with before," by customers (a, c, and d).
- 2) "Sales seem to have a higher priority than quality, and quality value seems to be inconsistent in Company C," by customer (a).
- 3) "Organizations within Company C seem to have a siloed structure, and it's not easy to do business with," by customer (a).
- 4) "The corporate attitudes of Company A or B before the merger were preferable to the attitude of Company C," by customers (a, c, and d).

However, after the third post-merger year, customers did not make such comments. Through these comments, customers had unexpectedly verified that there were conflicting cultural issues on quality culture levels 2 and 3 within Company C, and these negative perceptions had directly affected how quality-related items were evaluated in the quarterly business reviews. On the basis of the above consideration, the decrease of quality rankings can be seen as a result of the following factors: after the merger, the performance of Company C (as perceived by customers) worsened relative to other suppliers due to slowed responses and an increase in the time required to address quality incidents. Although quality data remained stable, evaluations of quality-related items declined significantly. In other words, Company C's attitude towards quality, related to quality culture levels 2 and 3, became inconsistent, which caused customers to distrust Company C. They then lowered Company C's score on quality-related items. The sharp recovery of the rankings in the third year after the merger also cannot be attributed to any evaluation criterion other than quality-related items, as was the series of decreases in the first year. Consequently, we inferred that the rebound resulted from the mitigation of factors that had caused the lower rankings. That is, inconsistencies in quality culture levels 2 and 3 had been removed by that time. Thus, cultural assimilation in its quality culture enabled Company C to establish consistent attitudes, which in turn led to improved quality-related items scores and subsequent recovery of the rankings to nearly their pre-merger level.

4.2. Quality incident processes and organizational decision-making efficiency

Quality incident processes include various activities by relevant functional sections that address a quality incident from its occurrence to its final resolution with the customer's consent. Fig. 5 shows an example of the quality incident process, which involves four major sections: QA, design engineering, production, and customer support. When a quality incident occurs, QA immediately takes charge of the situation in partnership with customer support, determines an action plan through game plan meetings with relevant sections, and then issues a flash report called a QA bulletin. Design engineering assigns engineers and examines possible solutions in detail, and identifies specific measures to resolve the quality incident. This involves review meetings with relevant sections. Then, design engineering issues a complete design of the resolution measures and arranges for their execution. Production adjusts

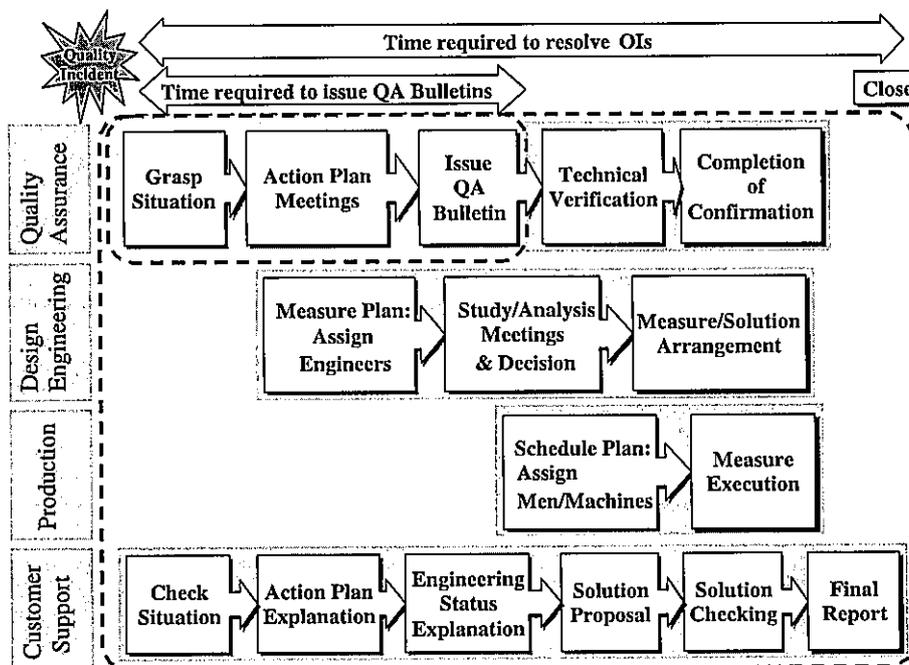


Fig. 5. Sample quality incident process workflow.

schedule plans and assigns personnel and machines as needed, and executes the measures according to instructions issued by design engineering. QA performs technical verification of the measures and confirms that the measures are executed successfully. Customer support performs a series of customer explanations and issues reports depending on the customer's situation and the progress made in the quality incident process. Thus, there should be numerous interactions among relevant sections in each step of the quality incident process. Although the sample in Fig. 5 seems to depict a straightforward process, many changes, even retracing, may happen as feedback is received about the situation in latter steps. We focused on two time measurements. One is "Time required to issue QA bulletins." This is the time elapsed from the occurrence of a quality incident to the issuance of a QA bulletin as shown in Fig. 5. This depends on the efficiency of the QA section because of having exclusive authority to issue a QA bulletin.

The other is "Time required to resolve quality incidents." This is the time elapsed from the occurrence of the quality incident to its final resolution as shown in Fig. 5. This depends on the efficiency of all relevant sections, including QA, design engineering, production, customer support, and others that might be required to address an individual quality incident. In the quality incident process QA plays two reporting roles. In one role, QA issues QA bulletins as described above that initiate the quality incident process. In its other reporting role, QA issues QA reports that track the status of each quality incident every week. These may not be unique to Company C, and similar reporting mechanisms are likely to be used in other companies using ISO 9001 Quality Management Systems. The following items are included in QA bulletins: quality incident title, issue date, publisher/approver, severity rating, customer name, product name, occurrence date, problem summary, cause (if known), and tentative action plan. The QA reports include countermeasures/actions, actions' owners, due date, and current status for every quality incident that has not yet closed. As the QA bulletin is event-driven, it must be issued as soon as the contents are established, and the progress of the countermeasures against each quality incident is tracked until its closure in the QA reports. Thus, by analyzing the QA bulletins and corresponding QA reports, the time measurements for each quality incident can be found.

4.2.1. Organizational decision-making efficiency in the quality incident process

The quality incidents were unexpected events and most were unique, having never occurred before. Countermeasures against such events cannot be pre-determined. Therefore, in each step of the quality incident process, there should be discussions and negotiations among relevant sections, and in most cases irregular or non-routine decision-making is required by each section to effectively address the quality incident. We define decision-making efficiency in the quality incident process here. There have been a number of studies on the subject of the efficiency of organizational decision-making. Simon (1945) said in "Administrative behavior" that in decision-making in a large organization, a decision-maker may make decisions according to the value of the limited range that was integrated with the functional section where he or she belongs, and it causes dispute and competition among sections. Cyert and March (1964) stated in "A behavioral theory of the firm" that "Basically we have argued that most organizations most of the time exist and thrive with considerable latent conflict of goal. Except at the level of non-operational objectives, there is no internal consensus." Salk and Brannen (2000) revealed in their study on a multinational management team that the efficiency of decision-making was highly correlated with a preference for consensus within relevant managers. We should use a consensus-building perspective when studying the efficiency of decision-making. According to Innami (1999), decision-making within a company is sometimes stalled by discussions and negotiations among various interest groups and functional sections. Factors that impact these discussions and determine the speed of decision-making are as follows:

- 1) Whether the organizational philosophy, mission, vision, and values of the company are clearly understood and adopted.
- 2) Whether the organizational authority and responsibilities are clear and whether the organizational structure is rational.
- 3) Whether there is any distrust among various sections caused by cultural differences.

Innami (1999) concluded that the speed of organizational decision-making depends on the extent to which relevant sections within the company share the same cultural values. We support this assertion on the basis of our personal experience, as each of the three authors has over 20 years experience in managing business organizations and realizes that cultural values shared among the sections that participate in decision-making influences the efficiency of the decision-making process. Consequently, it follows that the assimilation of organizational culture should shorten the decision-making processes. This should be the case during the quality incident process. We framed the two time measurements studied here in terms of efficiency as well, calling them together "decision-making efficiency in the quality incident process." "Time required to issue QA bulletins" was termed "decision-making efficiency when issuing QA bulletins" and "time required to resolve quality incidents" was termed "decision-making efficiency when resolving quality incidents," because these time measurements are highly dependent on the results of decision-making in relevant sections. However, these terms must be interpreted carefully because they represent two different elements. The first is the time required to make a decision about what action to choose, and the second is the time required to execute the chosen action. Since the quality incident process was not a straightforward process, but a continuous process of trial and error, these two elements in the quality incident process affected each other interactively. Therefore, separating these two elements in the quality incident process is not practical. Thus, saying that "decision-making efficiency" is high, implies that the time required to make a decision is short and/or the time required to execute a selected action is short because either a quick action was selected or the decision is implemented quickly with sufficient resources assigned.

4.2.2. Analysis of decision-making efficiency in the quality incident process

Company C's database of QA bulletins and QA reports included all quality incident records, a total of 301 quality incidents, occurring over the period of five years after the merger. The two time measures were extracted and analyzed for each quality incident. The results of analyzing quality incident processing time are shown in Fig. 6.

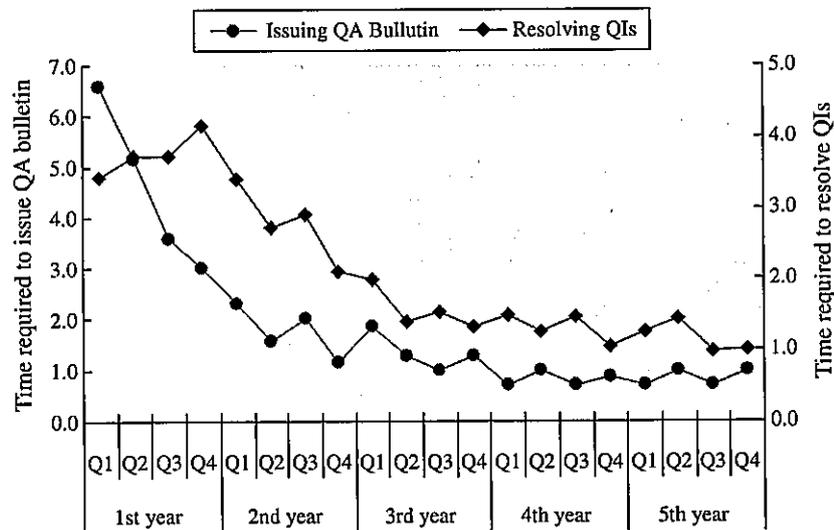


Fig. 6. Quality incident time measures over the transition period.

In this chart, the Y-axis shows the number of days, but is a normalized number in which 1.0 equals the number of days as of Q4 in the fifth post-merger year.

The results of this analysis were based on the following assumptions, which arose from Company C's specific situation:

- 1) The number and skill level of company employees involved in the quality incident process did not change significantly after the merger. Thus, Company C's ability to resolve quality incidents remained quite consistent.
- 2) Although quality incidents vary in difficulty and complexity, the statistical average time series shows trends that allow us to interpret changes in the efficiency of the quality incident process.
- 3) As engineers from both Companies A and B had experience addressing quality incidents, a learning curve theory for quality incidents is not applicable in this case.

4.2.3. Decision-making efficiency when issuing QA bulletins

Issuing QA bulletins is the sole responsibility of the QA section, which took the following steps in issuing QA bulletins as shown in Fig. 5:

- 1) Confirmation of occurrence and status of quality incident.
- 2) Examination of action plan (game plan meetings, deciding the owner responsible for addressing the quality incident (quality incident owner), and laying out a tentative action plan).
- 3) Issuing the QA bulletin.

The above process relies heavily on decision-making, such as step 2), which is generally the most time-consuming step. Interview respondents who were QA managers (1, 4, and 5) provided similar comments about step 2) that, although QA had authority over the designation of the quality incident owner, it took time to reach a consensus even in an internal QA discussion when members involved had different views based upon their quality values. Fig. 6 shows that the time required to issue the QA bulletins had decreased to one-fifth of the initial value by Q2 of the second year after the merger. This means that decision-making efficiency when issuing QA bulletins rose sharply in the first year after the merger. Why did this occur? QA manager (5) clearly stated that senior management in QA instigated a mechanism of quality reporting, including issuing QA bulletins, that quickly permeated the QA section. In fact, Company C's records showed that in the PMI phase, immediately after the decision about Company C's quality system, such elements as organizations, processes and specifications (categorized as level 1), and common quality values regarding QA functions such as operational norms and guidelines for issuing QA bulletins (categorized as level 2) were specified and documented by a PMI team. Further, that documentation included such details as classification of quality incidents, criteria for deciding the importance and severity of quality incidents, a QA bulletin template, and detailed procedures for issuing QA bulletins. That is, those QA functions at quality culture level 2 had been well stipulated as explicit knowledge in the PMI phase. Thus, at the beginning of Company C, all members in the QA section were ready to learn what they were expected to do and how it should be done upon the occurrence of quality incidents, through directions from higher management and/or interactions with each other. Further, QA managers (1, 4, and 5) unanimously stated that they had been making efforts to lead the quality reporting mechanism, including the QA bulletin, at every opportunity since the beginning of Company C. They also felt that these quality cultural elements had thoroughly infiltrated the QA section members' culture within the first year after the merger. From these facts, we inferred that assimilation of quality culture level 2 in the QA section had been proceeding efficiently and had been nearly fully accomplished in the first post-merger year. However, whether the base-level quality principles that make up quality culture level 3 were also assimilated into the QA section as well is an open question.

According to the QA managers (1, 4, and 5), they recognized that a number of examples continued to exhibit inconsistencies in level 3 factor of quality culture among members during the first year, most of which were revealed in negotiations with other functional sections, and they felt that level 3 assimilation could not have been established in the QA section until around the third post-merger year. The implications drawn from these statements were that cultural assimilation seemed to progress from level 1 through level 3 in sequence, and the degree of level 2 cultural assimilation is associated with decision-making efficiency in issuing QA bulletins.

4.2.4. Decision-making efficiency when resolving quality incidents

To resolve a quality incident, all concerned functional sections must participate. Therefore, the time required to resolve a quality incident depends on the efficiency of all related sections. In the first year after the merger, the time needed to resolve quality incidents actually increased, as shown in Fig. 6. As multiple respondents (1, 4, and 5) observed, in the beginning, just after the merger, cultural factors caused delays in taking actions, likely because the distinct quality cultures of Companies A and B had not yet been assimilated at levels 2 and 3 in all related sections. As previously discussed, we considered that the efficiency of organizational decision-making depends on the degree to which relevant sections possess a shared set of cultural values. The lingering cultural differences could cause conflicts and result in a decline in decision-making efficiency when resolving quality incidents due to long discussions and negotiations and/or being unable to make decisions to resolve the quality incidents more quickly. However, after the efficiency reached its nadir at the end of the first year, it tended to improve in the second post-merger year and doubled in one year. After the middle of the third post-merger year, the efficiency stabilized. What made the efficiency improve? As can be seen in Fig. 3, the number of quality incidents did not change greatly from that of the first year's. Further, QA manager (4) stated that there were no significant changes in either the organization or the number of engineers in quality incident-related sections at that time, but a company-wide quality initiative began in Q2 of the second year focusing on optimizing organizational culture and the structure of all related sections in Company C. This quality initiative might have contributed to accelerating the improvement of resolving quality incidents, but the improvement had already appeared in Q1 of the second year. We assumed that the efficiency improvement was supported by the increasing cultural assimilation at levels 2 and 3 in all relevant sections. The results of the questionnaire survey support this assertion, that is, 55% of respondents felt that cultural assimilation in Company C had been achieved during the first and the third year after the merger. As described in a previous section, the assimilation of level 2 features of quality culture in a single section, QA, was closely related to decision-making efficiency in issuing QA bulletins. However, in this case, because there were a number of inter-related functional sections involved, it was impossible to specify common decision-making criteria in advance as rules or guidelines applicable to every quality incident situation in multiple functional sections. As a result, most decision-making in each section had to rely on implicit rules and assumptions, which are categorized as quality culture levels 2 and 3. Instead, sufficient discussions and/or negotiations should be required to build consensus among relevant sections. Consequently, decision-making efficiency when addressing quality incidents depends on the degree of quality culture assimilation at the overall level of quality culture in all relevant sections. That is, the efficiency of resolving quality incidents would not increase without increased assimilation at quality culture level 3. The implication drawn from these observations was that the degree of quality culture assimilation at overall level in all relevant sections is associated with decision-making efficiency in resolving quality incidents.

According to the interviewee (4) who had been a QA manager in Company A, the number of days for resolving quality incidents in the latter half of the third post-merger year was in the normal range for Company A before the merger. This also supports many respondents' impression that Company C had achieved full quality culture assimilation in the third post-merger year. Further, a strong correlation was observed between the efficiency of decision-making in resolving quality incidents and the quality rankings received in quarterly business reviews (correlation coefficient = .74). Quality rankings were derived from customers' rankings during the next term and were synchronized upon comparison. This correlation was statistically significant at the 1% level. Consequently, we inferred that the degree of quality culture assimilation overall strongly related to the efficiency of organizational decision-making in the resolution of quality incidents, which in turn affected the customers' quality ratings.

4.3. Simulation modeling of the cultural assimilation process

We developed a simulation model of cultural assimilation by using agent-based modeling, and conducted experiments in the most likely condition of Company C on the basis of the data and interviews with relevant managers. The process of cultural assimilation in the model can be described as a series of events in which agents (organization members) are active. Our basic idea is that agents are likely "to interact with each other and/or to acquire top-down directions from the management" (hereafter called "repetitive action") and then become more similar as cultural assimilation progresses. We referred to Axelrod (1997a) disseminating culture model and attempted to extend it. In Axelrod's simulation, hundreds of agents were placed on a fixed lattice. Each agent holds five attributional features with 10 possible traits in each feature, and interacts with one of its neighbors who directly connected by ties. Agents' initial cultural traits were determined randomly. The simulation follows two steps and repeats those for as many iterations as desired. At first, randomly select an agent to be active and pick one of its neighbors; then, with probability equal to their cultural similarity, these two agents interact. An interaction consists of selecting at random a feature on which the active agent and its neighbor differ (if there is one) and changing the active agent's trait to the neighbor's trait on this feature. In our model, hundreds of agents were placed in the virtual Company C, which is not necessarily a fixed lattice but only an agent space. Each agent holds three dimensions that stand for quality culture levels 1 through 3 with three possible traits that can represent their cultural traits, such as Company A, Company B, and Company C (Company C culture is different from both Companies A and B cultures). These three traits suffice for the simulation because quality culture as defined in this study

represents a generally shared culture in the entire company. Every agent also has two assimilation parameters, $P1$ and $P2$, each with a value between 0.0 and 1.0 as the probability of changing their cultural trait through repetitive actions. $P1$ represents the degree of agents' intention to adopt top-down culture, and $P2$ represents the degree of agents' intention to adopt the other agents' culture. The purpose of this simulation is to examine the time-series trends of the cultural index for decision-making (DMI), which is dependent upon the cultural similarity among agents who participate in Company C's organizational decision-making. Therefore, we examine time dependently on a quarterly basis, and the number of events per quarter should be determined by the number of organizational decision-making events per quarter, whereas there was no limitation on the number of events in Axelrod's model. The simulation dynamics of our model also differs from Axelrod's model. The explanation of our model and simulation dynamics is presented in Appendix A.1. Before we conducted experiments, the condition of the simulation should be specified as that most likely for Company C. Appendix A.2 presents the simulation parameters in the most likely condition.

4.3.1. Simulation results

Fig. 7 indicates the time-series trends of DMI for levels 1 through 2 ($DMI12$) and levels 1 through 3 ($DMI13$). Those shown here are averages for each experimental condition, and one curve represents the averages of 100 trials in one cultural inertia condition. In all conditions, a decreasing trend of both $DMI12$ and $DMI13$ are observed in the early steps, after which they hit their nadir or remained at a low level, then began increasing, and finally reached an equilibrium condition at the maximum value 1.0. Hereafter, called the "initial sluggish period" in which $DMI13$ initially decreased or remained at a lower level until it began increasing rapidly. $DMI13 = 1.0$ means that the cultural traits of all agents have converged and achieved an equilibrium, that is cultural assimilation, and one dominant trait, top-down culture, has emerged. These are very different from the results in Axelrod's simulation, in which a number of different cultures emerged when reaching an equilibrium condition, but are not contrary to our expectations, because we extended Axelrod's model by adding the effect of top-down directions and the extraction of active agents was performed randomly from the entire agent space. The results also show that the greater cultural inertia, the longer the initial sluggish period. When we also performed the experiment in several different conditions of both $P1$ and $P2$, the results showed a similar trend although there were slight differences (± 1 quarter) in the length of the initial sluggish period when the following conditions were satisfied: $P1$ of ex-A ($P1A$) was 0.2–0.4, $P1$ of ex-B ($P1B$) was 0.6–0.8, $P2$ of ex-A ($P2A$) was 0.5–0.7, and $P2$ of ex-B ($P2B$) was 0.1–0.3. When both $P1A$ and $P1B$ were zero, a mixed culture of cultures A and B occasionally emerged, taking a long period (more than five years) to reach an equilibrium condition. As long as both $P1A$ and $P1B$ were not zero, a top-down culture always finally emerged as a single dominant culture, the time required for cultural assimilation depended more on the value of $P1$, and the larger value of $P2$ accelerated the convergence.

In this chart, $r1$, $r2$, and $r3$ are the cultural inertia for quality culture levels 1, 2, and 3, respectively.

We attempted to experiment with different top-down cultures as well. If we set the top-down culture to culture B, which is the most abundant culture in the initial condition, then an initial sluggish period was not observed, and both $DMI12$ and $DMI13$ showed a steadily increasing trend toward cultural assimilation; however, if we set the top-down culture to culture A, a similar initial sluggish period to culture C's case was observed. Thus, this model could serve as a trial tool for managers to examine the transition of cultural assimilation under various conditions of corporate integration to inform their merger planning.

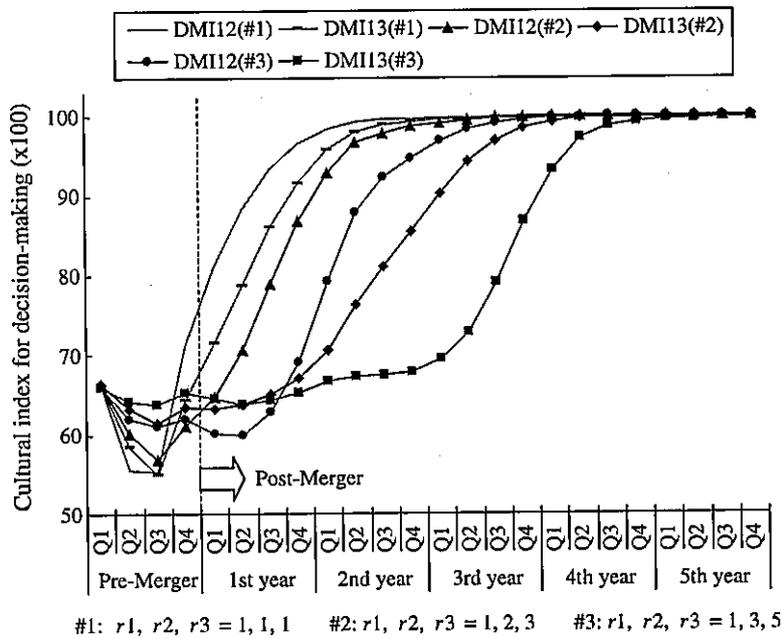


Fig. 7. Cultural index for decision-making (DMI) in simulation.

4.3.2. Comparison between simulation results and actual case data

The time-series trends of *DMI12* and *DMI13* seem similar to the trend of the decision-making efficiency in the quality incident process. Fig. 8 presents both the simulation results of *DMI12* and *DMI13* and the case data of the decision-making efficiency in the quality incident process. In this chart, the data of both issuing QA bulletins and resolving quality incidents were converted to the degree of attainment of the final value, that is 100, and the range was adjusted to compare readily with *DMI12* and *DMI13*.

The purpose of this comparison is to examine whether the evolution of *DMI12* and *DMI13* are similar to the efficiency evolution of issuing QA bulletins and resolving quality incidents, respectively. As the chart illustrates, when we assumed cultural inertia, $r_1, r_2, r_3 = 1, 2, 3$, these transitions are closely comparable. Together, the modeling study of cultural assimilation process demonstrates that the progress of cultural assimilation can be made visible in each layer, and the transition of the degree of cultural assimilation in the simulation is closely comparable with the evolution of the decision-making efficiency in the quality incident process. Therefore, we believe that the simulation modeling makes a linkage between our assimilation theory and the empirical findings.

4.3.3. Limitations of the model

Although the model was fundamentally based on Axelrod (1997a), there are several limitations in this model simulation as it has own assumptions. The occasions to change agents' cultural traits were implemented in this study as their participation in organizational decision-making. The probability of each repetitive action, either interaction with other agents or top-down directions taken, was assumed at 50%, and the most abundant cultural trait was used as the reference culture in interactions. These mechanisms can be modeled in many other ways, and there is a probability that the results might be different under another mechanism. Axelrod (1997b) asserted that the goal of agent-based modeling is to enrich our understanding of fundamental processes that may appear in a variety of applications, and requires adhering to the KISS principle, which stands for the army slogan "keep it simple, stupid!" It seems reasonable to assume that our model was quite simple and thus relatively realistic, and the validity of its result was clearly supported by this study's empirical findings. There are also several ways to extend our model. One possible extension is to set the cultural inertia for agents individually according to their length of service or other attributes. Another extension would be introducing a new mechanism for people who leave the company due to incompatibility of their cultural traits and newcomers who join the company with new and different cultural traits. Whether these extensions would affect our result remains to be tested.

5. Discussion and implications

This study explored the process of cultural assimilation in an actual M&A case with the purpose of suggesting strategies that corporate management can adopt prior to future M&As. In view of the importance of understanding the antecedents and consequences of cultural assimilation, several qualitative findings should also stimulate future research in corporate consolidations.

5.1. Quality as an index of corporate performance

In this study, quality was used as an index for evaluating corporate performance. As quality is by definition the degree to which customers' needs or expectations are fulfilled, it is difficult to define criteria for quality quantitatively and in advance. In addition, customers' needs or expectations are not static, but fluid, as they vary when situations such as business trends, market circumstances, competitors' movements, and the like change. Therefore, few recent studies have adopted "quality" as a measure of corporate performance. This study challenges the current approach. In B2B models, the number of both suppliers and customers are limited and the

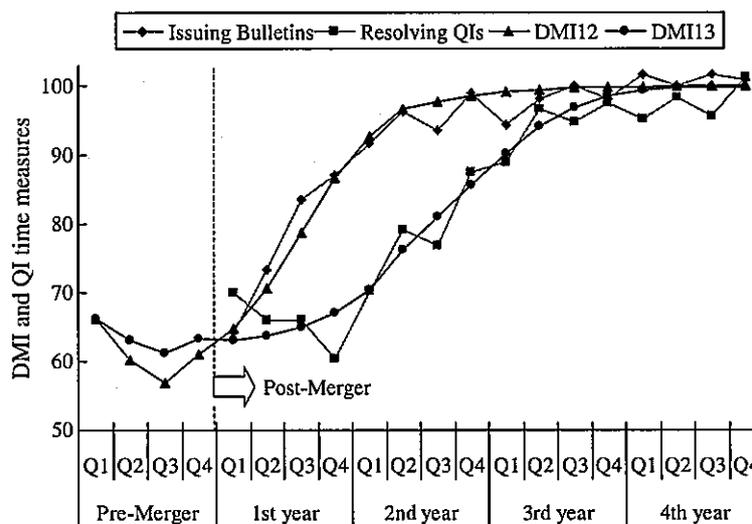


Fig. 8. Cultural index for decision-making (DMI) vs. quality incident time measures. Cultural Inertia: $r_1, r_2, r_3 = 1, 2, 3$.

examination of quality should be feasible. Further, quality is a key measure in maintaining business relationships between customers and suppliers. Thus, it is practical to use quality as a key index to evaluate corporate performance, particularly in the B2B environment. Several somewhat surprising and counterintuitive findings were brought to light using a quality index constructed from customers' evaluations. The number of quality-related incidents seemed to not necessarily hurt customers' quality ratings. Also, one major customer who had procured the largest volume of products assessed their suppliers' quality more on the basis of their perceptual measures than on the products' quantitative quality performance. These facts suggested there was the case that qualitative assessment such as the degree of suppliers' cooperation and contribution on quality-related incidents may be more important rather than quantitative quality data in the evaluation of quality by customers. These must be interpreted carefully due to the limited scope of this case. Nevertheless, they are intriguing and should motivate researchers to analyze quality as an index of corporate performance. A limitation of this study design is that case analysis is rather difficult to perform with only publicly available materials about the object companies. However, future studies using observations and active data collection approaches on other cases should give more definite implications on quality as an index of corporate performance.

5.2. Internal inconsistencies of quality culture and its assimilation process simulation

Current research on M&As has suggested that differences in organizational culture can be a major cause of failure to achieve synergies, yet few papers have discussed which processes are at fault and how they relate the merged company's performance. Although the analysis in the present study is limited to one specific case, we showed that longer periods to resolve quality incidents were a dominant factor in customers' lower post-merger quality ratings, and a higher degree of quality culture assimilation was negatively associated with longer resolution time of quality incidents. One of the insights gleaned from this research is that internal quality culture inconsistencies after a merger are negatively associated with the merged company's quality performance. This means that even if the quality culture of each company had a positive relation to each one's quality performance before the merger, as did Companies A and B, when the two companies merge into one entity, internal inconsistencies in quality culture will have a negative relation to the quality performance of the company. A strong correlation between the degree of quality cultural assimilation and the recovery of customers' quality ratings was also observed. From these facts, we inferred that customers' quality ratings depend heavily upon consistency in quality culture, an indispensable attribute for companies that provide products and services.

In cross-border M&As involving companies that have very different national cultures, the initial sluggish period in cultural assimilation might be longer than that for domestic M&As due to greater cultural inertia. In such case, the speed of cultural assimilation becomes more significant. To shorten the initial sluggish period after launching the integration program, our modeling study suggests the following implications. If the conditions and the parameters of the integration have been given, such as the number of agents, the ratio between merging companies, their assimilation parameters, the cultural inertia, and the top-down culture, then the corporate management of a merged company should act to increase the number of opportunities for organizational decision-making involving a broad range of agents, and also should make clear statements concerning quality culture at every opportunity. In preparation for M&As, corporate management might predict the above parameters for both their own company and each candidate partner company through a feasibility study, and thus examine the partner's appropriateness via model simulations. Cases in which the partner has already been selected, the results of model simulations can guide them in the planning to management of the integration process.

5.3. Degree of cultural assimilation and its relation to organizational decision-making

In the present study, we analyzed the process of resolving post-merger quality incidents, and examined how the efficiency of organizational decision-making in that process changed on the basis of data from an actual merged company. An insight derived from our study concerns the relationship between the degree of cultural assimilation in each layer of quality culture and the efficiency of organizational decision-making. The degree of assimilation in quality culture level 2 is associated with the efficiency of organizational decision-making within a single functional section. The degree of assimilation in quality culture level 3, the deepest level, is associated with the efficiency of organizational decision-making across multiple functional sections. Fig. 9 illustrates this relationship, revealing that the efficiency of organizational decision-making rises when it reaches a deeper layer of cultural assimilation. Based on the analysis of the case data, although the efficiency of decision-making by a single functional section had stabilized, by the time that section had become assimilated at quality culture level 2, the efficiency of decision-making across multiple functional sections did not reach a stable level until assimilation advanced to quality culture level 3. Our modeling study results also showed that the evolution of the degree of assimilation in level 2 is compatible with that of the efficiency of organizational decision-making in a single functional section; concurrently the evolution of the degree of assimilation in level 3 is compatible with that of the efficiency of organizational decision-making across multiple functional sections. It thus seems reasonable to infer that the degree of cultural assimilation at deeper layers is associated with the efficiency of organizational decision-making.

Although this finding is based on a single case, it should stimulate further research on the role of cultural assimilation at deeper layers, which could in turn increase the probability of suggesting management strategies to be adopted prior to future corporate consolidations.

5.4. Possibility of proposing pre-M&A management strategies and future research

This exploratory research has focused on cultural assimilation in a company formed by M&A. Whether these findings could be replicated by other case studies is an open question. Whether internal inconsistencies in a company's quality culture impact

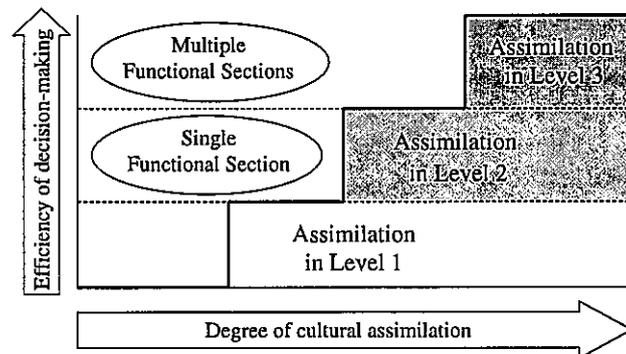


Fig. 9. Efficiency of decision-making and degree of cultural assimilation.

quality performance or whether the degree of cultural assimilation is associated with the efficiency of organizational decision-making in other cases or in other industries should be examined by future research. However, internal inconsistencies of quality culture after a merger are predictable and might be avoidable if certain measures to reduce them were taken before a merger. For example, when two companies with very different organizational cultures merge into one company, cultural integration projects that promote cultural assimilation should be executed with increasingly high priority as the integration of organizations and business processes proceeds. Restructuring of the organization and functional sections' roles and responsibilities might also be needed. If cultural assimilation to level 3 is expected to take a considerable amount of time, corporate management might, among other options, divide and compartmentalize the organization into independent sections in which decision-making is relatively unaffected by other sections. This might avoid a slump in decision-making efficiency, even though a new organizational culture is introduced after the merger. Another option might be to combine various sections that have already assimilated the organizational culture into one large group, maintaining their organizational culture as it is, and manage that group as an independent business unit.

Future research could analyze other cases, both successful and failed attempts, to derive further theories and related pragmatic suggestions. There are many M&A cases, but it seems most promising to focus on cases in which both companies are in similar businesses but have very different organizational cultures. Researchers could study whether the evolution of cultural assimilation resembles that observed in this study. Different approaches to exploring the process of cultural assimilation such as agent-based simulations also hold promise. Researchers could extend the model in this study to experiment under the desired different conditions and compare the results. Those studies would enable the development of a clearer understanding of the entire process of cultural assimilation, as well as a better understanding of the specific impact of the deeper layers of organizational culture in different situational contexts of corporate consolidation. Such studies might also help to develop a more general theory about the antecedents and consequences of cultural assimilation in corporate consolidations.

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Appendix A

A.1. The model and simulation dynamics

The model is defined by considering N agents. The state of agent i (S_i) is a vector of three components (dimensions), $S_i = (ci_1, ci_2, ci_3)$. Each component can take any of the values (cultural traits) in the set $\{A, B, C\}$, and ci_1 , ci_2 , and ci_3 correspond to quality culture levels 1, 2, and 3, respectively. The agent i also has two parameters, $P1_i$ and $P2_i$. As an initial condition, the states of agents who are ex-A are assigned (A, A, A) and agents who are ex-B are assigned (B, B, B) , and (C, C, C) is assigned as a "top-down culture" (TDC). We define the cultural inertia r_1 , r_2 , and r_3 for quality culture levels 1, 2, and 3, respectively, and these are applied to all agents. Each inertia value can take an integral number $(1 \sim q)$, where q specifies the number of repetitive actions required to change the cultural trait. The complete dynamics of our model are described below.

- 1) Set the number of organizational decision-making events ($ND = 1 \sim k$) in this quarter.
- 2) Select at random m agents in the virtual Company C as members of a decision-making group. That is, m denotes the number of agents who are active and likely to perform a repetitive action.
- 3) Calculate the cultural index for decision-making (DMI) on the basis of the cultural similarity in the decision-making group. Also, obtain "the most abundant cultural trait" (MAC) of all agents in the group. $MAC = (ca_1, ca_2, ca_3)$. When certain traits

are shared equally among the agents in the group, one of them is selected randomly as *MAC*. The cultural similarity of agent *i* (*CSi*) in the group is calculated with weightings by assuming that the weightings are determined by the cultural inertia of each level, and then *DMI* is calculated by the following steps:

- First, calculate the number of shared traits of agent *i* (*NSi*) among the agents in the group.

$$NSi \text{ for level 1, } NSi1 = \sum_{j=1}^m \delta ci1, cj1, \quad \delta ci1, cj1 = \begin{cases} 1 (ci1 = cj1) \\ 0 (\text{otherwise}) \end{cases}, \quad (A1.1)$$

$$NSi \text{ for level 2, } NSi2 = \sum_{j=1}^m \delta ci2, cj2, \quad \delta ci2, cj2 = \begin{cases} 1 (ci2 = cj2) \\ 0 (\text{otherwise}) \end{cases}, \quad (A1.2)$$

$$NSi \text{ for level 3, } NSi3 = \sum_{j=1}^m \delta ci3, cj3, \quad \delta ci3, cj3 = \begin{cases} 1 (ci3 = cj3) \\ 0 (\text{otherwise}) \end{cases}. \quad (A1.3)$$

- Second, calculate the cultural similarity of agent *i* (*CSi*).

$$\text{Similarity of level 1 : } CSi1 = \frac{NSi1}{m}, \quad (A1.4)$$

$$\text{Similarity of level 1 through 2 : } CSi12 = \frac{r1NSi1 + r2NSi2}{(r1 + r2)m}, \quad (A1.5)$$

$$\text{Similarity of level 1 through 3 : } CSi13 = \frac{r1NSi1 + r2NSi2 + r3NSi3}{(r1 + r2 + r3)m}. \quad (A1.6)$$

- Third, calculate *DMI* at $ND = k$ by assuming that the degree of contribution by each agent is random. *DMI* for levels 1 through 2: *DMIk12*, and *DMI* for levels 1 through 3: *DMIk13* are

$$DMIk12 = \sum_{i=1}^m \alpha i CSi12, \quad DMIk13 = \sum_{i=1}^m \alpha i CSi13. \quad (A1.7)$$

Here, αi is uniformly a random number ($\geq 0.0, < 1.0$) and $\sum_{i=1}^m \alpha i = 1.0$.

- 4) Gradually take following actions related to repetitive actions for all agents in the group.

- First, with 50% probability, calculate the chance of repetitive actions either from interaction or from top-down and set a reference culture (*RC*: $cr1, cr2, cr3$) and a parameter (Pi). That is, ($cr1, cr2, cr3$) and Pi are set to either ($ca1, ca2, ca3$) and $P2i$, or (C, C, C) and $P1i$.
- Second, compare the cultural trait of level 1 ($ci1$) with the reference culture of level 1 ($cr1$). If $ci1 \neq cr1$, with probability Pi , change $ci1$ to $cr1$ when the counter of this action is equal to $r1$; otherwise, no change occurs, but add 1 to the counter of this action, and then move to the next agent in the group. If $ci1 = cr1$, then go to the next comparison step of level 2.
- Third, compare the cultural trait of level 2 ($ci2$) with the reference culture of level 2 ($cr2$). If $ci2 \neq cr2$, with probability Pi , change $ci2$ to $cr2$ when the counter of this action is equal to $r2$; otherwise, no change occurs, but add 1 to the counter of this action, and then move to the next agent in the group. If $ci2 = cr2$, then go to the next comparison step of level 3.
- Fourth, compare the cultural trait of level 3 ($ci3$) with the reference culture of level 3 ($cr3$). If $ci3 \neq cr3$, with probability Pi , change $ci3$ to $cr3$ when the counter of this action is equal to $r3$; otherwise, no change occurs, but add 1 to the counter of this action, and then move to the next agent in the group. If $ci3 = cr3$, then move to the next agent in the group.

- 5) Repeat steps 2) through 4) until reaching *ND* times, and then calculate *DMI* (*DMi12* and *DMi13*) at this quarter.

$$DMi12 = \sum_{i=1}^k DMi12/ND, \quad DMi13 = \sum_{i=1}^k DMi13/ND. \quad (A1.8)$$

- 6) Return to 1) and repeat all the steps until the simulation period is over.

A.2. Simulation parameters in the most likely condition of Company C

- $N = 400$, 100 of ex-A and 300 of ex-B. *N* was the number of manager class people potentially involved in the quality incident process in Company C.

- Each agent had its own $P1$ and $P2$ assigned as normally distributed random number based on $P1A: \mu=0.3, P1B: \mu=0.7, P2A: \mu=0.6, P2B: \mu=0.2$, and $\sigma=0.1$ for all these. These were assumed based on the result of the questionnaire survey of Company C's managers.
- ND was 10 per week, m was 10 in pre-merger, and ND was 15 per quality incident, m was 6 in post-merger, These were set on the basis of interviews with Company C's managers who had been involved in both terms, pre-merger and post-merger.
- For cultural inertia, we assumed that a relation in the magnitude of $r1, r2, r3$ is $r1 \leq r2 \leq r3$ from its definition in Section 2.2. This relation was also supported by the results of interviews with Company C's managers. Thus, we created three experimental conditions. These were $r1, r2, r3 = 1, 1, 1, r1, r2, r3 = 1, 2, 3$ and $r1, r2, r3 = 1, 3, 5$.
- Simulation period was eight months (pre-merger) and five years (post-merger).

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