

The Impact of Lean Methods on Organizational Communication in Homebuilding

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Typically, many organizational problems are related to job dissatisfaction, lack of teamwork, job-related stress, lack of commitment, and lack of communication, which are the five factors of organizational communication. These five factors are expected to be affected by implementing Kaizen events from lean production. This paper describes the experiences of a modular homebuilder involved in manufacturing of stick built and SIP panel houses, their process improvement implementation through Kaizen events and its impact on organizational communication. In order to assess workers' level and quality of organizational communication before and after participating in a Kaizen event, an Organizational Communication Questionnaire (OCQ) was compiled from other validated questionnaires and then tailored for the construction industry. As a part of the pilot study, 5 construction workers were selected for the survey questionnaire and initial results showed improvement in job satisfaction, commitment, teamwork, and stress among the workers after the impact of Kaizen. Communication showed no variation of being impacted after the Kaizen events. Results from this study illustrated a potential link between lean and improved organizational communication. This study was a pilot study limited to a small sample size for statistical analysis, and yielded preliminary results. The results from the study explored the basis for a future study of a larger sample size.

Key words: Kaizen, lean, organizational communication, modular home builders

Introduction

In construction, communication problems have emerged as one of the most significant contemporary challenges facing workers and companies (Hoezen, 2006). However, little research has investigated the impact of process improvements, in particular Kaizen events, on organizational communication. Organizational communication entails five factors related to the work environment—job satisfaction, teamwork, job stress, commitment, and communication (Rodwell, 1998). In the construction industry all these factors play an important role in the success of a construction project. Lean is a managerial approach for improving productivity of an organization and it has been proposed as a strategy to improve communication among construction workers (Byrne et.al, 2006). This paper describes the experiences of a modular homebuilder applying process improvement through Kaizen events and its impact on organizational communication.

Literature Review

Lean Production: An Overview for the Construction Industry

The lean production system started with the Toyota Production System (Ohno, 1988), where its implementation made a revolutionary change in the manufacturing sector. Lean production is based on five fundamental principles: 1) identify the customer values 2) identify the value stream and challenge all wasted steps 3) produce the product when the customer wants it, and once started keep the product flowing continuously through the value stream 4) introduce pull between all steps where continuous flow is impossible and 5) manage toward perfection (Womack and Jones, 1996). In construction the application of lean stems from a discussion of Koskela's work (1993), which

emphasized the importance of the production process flow. Furthermore, lean is a whole management system, and workers are responsible for maintaining continuous flow of work and the information in the production process (Howell, 1998 and Ballard, 1998). Similarly, Howell (1998) argues that lean thinking is a new way to manage construction. Hook and Stehn (2008) discuss the implementation of lean principles in construction, in particular the industrialized homebuilding industry, throughout the organization from top management to the labor force. Their study shows that the successful implementation of lean requires an organizational culture change, in particular encouraging employee empowerment.

Kaizen Events

Kaizen, typically referred to as an event, is an intensive and focused approach to process improvement. This lean strategy seeks operational perfection by eliminating waste – non-value added activities from the perspective of the customer. Conducting a Kaizen event helps to eliminate waste by empowering employees with the responsibility, time, and tools to uncover areas for improvement and to support change. This type of activity is team based and involves employees from different levels of the organization. Traditionally, the purpose of the Kaizen event is to continuously improve and instill a lean culture in the company through the use of lean principles and tools. The benefits of Kaizen are associated with both individual workers and the company as a whole. In term of a company's benefits, Kaizen reduces overhead cost due to production waste, it improves the quality of the product by reducing non value added activities, and it reduces the total cycle time for the production process (PDTP, 2002). From the workers' perspective, Kaizen benefits them in terms of working culture or environment, freedom and ease in work, and initiatives and innovation for work (PDTP, 2002). In order to achieve these benefits, the Kaizen event needs to be implemented in an organized manner with well defined roles for participants. A traditional Kaizen event entails three phases: 1) planning and preparation 2) implementation and 3) presentation of the results (Figure 1). Kaizen has proven to be effective as an organizational improvement mechanism which supports employee development and improves the work environment (Farris, 2009). Thus, Kaizen events can be a good strategy to improve organizational communication.

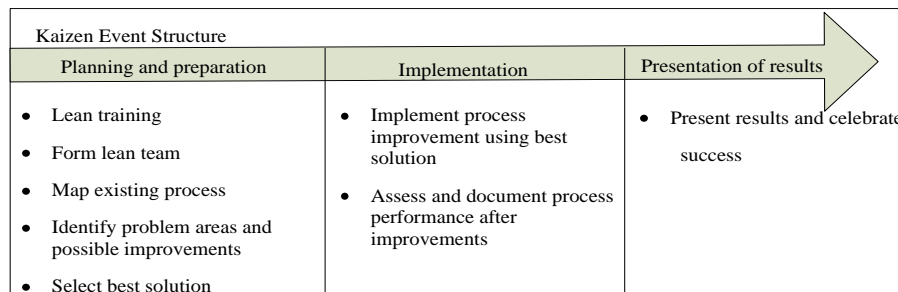


Figure 1. Typical Kaizen Event Structure (modified from Chatterjee, 2008 and PDTP, 2002)

Organizational Communication

Organizational Communication (OC) deals with the interaction of human organization and human communication (Monge and Poole, 2008). OC is relevant to three main areas: spoken communication, written communication and organizational behavior (Leipzig et.al, 1990). Furthermore, organizational behavior entails two aspects of the individual: 1) An employee's involvement and 2) An employee's affective attitude (Rodwell, 1998). An employee's involvement refers to factors like communication and teamwork. An employee's affective attitude conveys job satisfaction, job commitment, and job related stress. These five factors affect the organizational behavior of an individual which in turn affects the organizational communication and represents the focus of this paper. Thus, all five factors (job satisfaction, teamwork, stress, commitment, and communication) have an important role to play not only in terms of individual workers' performance and productivity, but also in terms of the organization as a whole.

Job Satisfaction relates to task characteristics such as monotony, type of work, control over job, and work methods. Repetitive tasks and monotony of work may be a source of dissatisfaction for workers. Workers lacking the necessary skills to effectively perform certain tasks can also cause job dissatisfaction (Mutanenet.al. 1983).

Similarly, workers incapability of controlling their work might also contribute to job dissatisfaction which may in turn affect OC negatively (Mutanenet.al. 1983).

Teamwork means workers working as a group to achieve a common goal. Teamwork, if carried out effectively, results in motivated workers, improved job satisfaction, reduced overall work time, and can improve the quality of work (Griffin et.al, 2001). Other advantages of teamwork involve effective communication, effective problem solving, trusting and supportive environment within the group, creativity enhancement, and mutual problem resolution (Chow; et.al, 2005), all of which can improve organizational communication.

Job Stress can be related to job dissatisfaction, excessive work, limited time for completion and personal problems (Ford et.al, 1978). Job stress among workers may arise also due to the poor fit between workers abilities and the working environment. This affects workers not only psychologically but also physiologically disrupting their normal functioning during work (Jamal, 2009).

Commitment is an attitude of the worker towards an organization which predicts the degree of involvement of the worker in their organization (Harrison et.al, 1999). Commitment also includes considerable effort of the workers on behalf of an organization, belief in organizational goals and values, and desire to maintain membership in the organization (Chen et.al, 2004). A committed worker plays a significant role in the success of an organization (Gamble et.al, 2008). Commitment is found to have positive relationships with motivation, job performance and job satisfaction (Gamble et.al, 2008). Workers that are committed to the organization tend to perform at higher levels and are less likely to leave their jobs (Gamble et.al, 2008).

Communication refers to the exchange of information between workers during the period of work (Weick et.al, 1986). In an organization, communication is carried out in several ways including verbal communication and information flow through documents, symbols, and signs. Authority, control, and motivation are expressed through communication which has a significant role in the functioning of an organization (Roberts et.al, 2009). Workers communication needs to be effective to coordinate efforts, leading to improvement in quality of the work. Communication quality which has the characteristics of being timely, accurate, useful, and complete enhances productivity and the quality of work (Byrne; et.al, 2006).

The U.S. construction industry is challenged with organizational communication issues in employee's involvement, employee's affective attitude, working culture, and work life balance of workers (Lingard et.al, 2007). An employee's affective attitude, job satisfaction, organizational commitment, productivity turnover, and absenteeism affect work life balance (Lingard et.al, 2007). Furthermore, Leung (2008) suggested that commitment, job performance, and job satisfaction of construction workers have a significant impact on performance levels. Also, Park's (2008) study on job satisfaction of workers working in a team setting resulted in the conclusion that teamwork enhances job satisfaction. Organizational climate and job satisfaction are significantly related with organizational communication (Muchinsky, 1977). In addition to job satisfaction, commitment, and teamwork; stress also affects construction workers performance and organizations effectiveness. Due to the nature of construction projects, workers undergo stress due to time deadlines, uncertainties of projects, and the dynamic environment associated with construction projects. Leung (2008) found that the performance of workers slows down with increased stress. Similarly, Djebarni (1996) found that stress among workers during construction activities causes a decrease in performance. In addition to stress, the communication in organization also affects workers' performance and organizational success. Burton (1977) investigated the effects of role clarity (the amount of required information an organization communicates for the effective performance) on job satisfaction and organization's effectiveness. Burton (1977) concluded that effective communication provides the better role clarity for organization's success. Thus, factors like job satisfaction, teamwork, job stress, commitment, and communication plays a critical role in organization's effectiveness and success.

Improving Organizational Communication through Kaizen events

The current study proposes the use of Kaizen events to analyze organizational communication through an employee's involvement and an employee's attitude. Figure 2 displays the proposed relationship of Kaizen with an employee's involvement and an employee's affective attitude, which in turn affects organizational communication. Three phases of Kaizen events may affect the employee's involvement and affective attitude in different respects. Team formation, lean training, identification of problem, and possible improvements (Phase I) may drive affective

participation of individuals. Further, lean training and team formation during the first phase of the Kaizen may encourage teamwork. Identification of problems and role perception uniquely relates to commitment of workers before initialization of the job or task (Knippenberg, 2006). However, the planning and preparation of the work beforehand might induce stress initially among workers to complete the planned process or activities. Dale (2008) suggest that planning, scheduling, setting deadlines, and meeting standards for work drives job stress among the workers initially. During the work or process, acquaintance with job environment and indulgence in the work may possess potential to mitigate job stress (Dale, 2008).

The second phase of Kaizen might also an influence employee involvement in teamwork and communication. Implementation of the planned activities during the first phase might drive employees to work in groups, negotiate, and coordinate efforts. Further, better working environment of the planned activities also raises commitment of the workers to perform their duties (Lingard et.al. 2004). Job satisfaction and communication among the workers may also be influenced positively while performing well organized and coordinated work. Individuals working in an organized climate of work have better communication and job satisfaction (Muchinsky, 1977). Assessment of process performance may lead to an increase in stress among the workers to perform activities planned (Parasuraman, 1984). A general awareness meeting between supervisor and workers regarding the criteria, regulations, and requirements for assessment of process performance may help in mitigating stress.

Presentation of the results (Phase III) as a part of Kaizen events might lead to raised job satisfaction among workers, if the results are favorable and promising. The stress among workers may prevail if the results are not promising or have not yielded improvement. As job satisfaction uniquely relates to commitment (Knippenberg, 2006), it might drive commitment among the workers for improved and positive results. In general, effective communication and team work might result in better employee involvement in work and other organizational activities thereby improving organizational communication. Better job satisfaction, less stress, and improved commitment may have potential to contribute towards better employees' attitude.

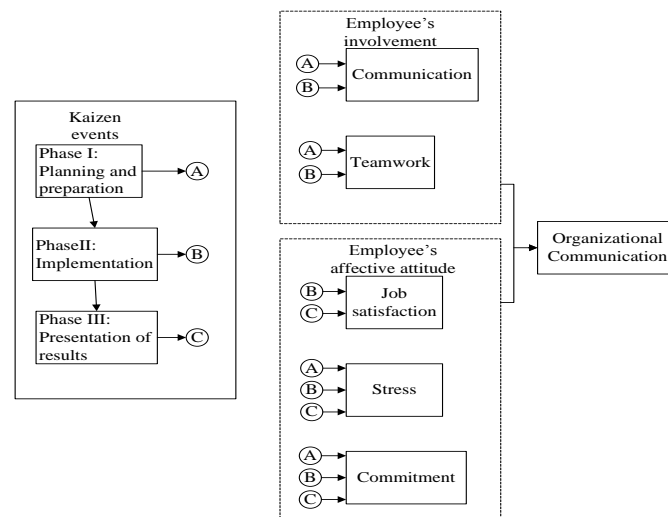


Figure 2. Proposed relationship of Kaizen with organizational communication

Case Study

A modular manufacturer was selected for this study. This plant produces the modular homes, which are either stick built (base, walls and ceiling) or a combination of stick built with Structural Insulated Panels (SIP) (walls and ceiling). Their current production rate is 12-15 homes per month. The company is involved in using precise assembly equipment and repetitive assembly-line techniques. The plant layout follows the sequential building process according to the manufacturing process for the modular homes, which includes 19 stations. Currently the plant has about 100 employees working on different stations across the plant.

Due to market pressures, this modular manufacturer is preparing to ramp up their production. However, their production process is experiencing several areas for concern that will hinder or prevent their planned production

expansion, including: 1) Inadequate material flow and procurement 2) Variable production rate among stations, in particular the base station and 3) Insufficient workforce. This study focuses on the base station (station 1) where the base frame for the modular homes is manufactured, and due to sequential nature of the construction process the work on the consecutive stations depends on station 1. In the past, delays in station 1 had a major impact in meeting the manufacturer's production schedule. In order to explore areas for implementing a Kaizen event, our research team conducted observations of the process flow and documented current cycle times.

The current study is a pilot study and is part of a larger research effort, which will entail the collection of a larger sample (> 60 worker). However, this paper presents initial results from the pilot study which includes five workers from station 1, to set up a base for further research. The data for this study was collected via a questionnaire, interviews, and process observations.

Organizational Communication (OC) Questionnaire was structured by using validated questionnaires from the literature (Rodwell, 1998; Hackman, 1980; Fournier, 2001; Rubin et.al, 1994) which documents different factors that influence OC. The OC questionnaire examines five factors - job satisfaction, teamwork, job stress, commitment, and communication (Rodwell, 1998). The OC questionnaire consists of 38 questions out of which 12 questions assess job satisfaction, 8 questions assess commitment, 7 questions assess teamwork, 7 questions assess stress, and 4 questions assess communication. This study repeated the OC questionnaire, before and after Kaizen event. Each OC questionnaire had two parts: 1) Employee demographics, 2) Questions for factors related to OC. The after Kaizen OC questionnaire included two extra questions related to the worker's participation on the process improvement event. Workers were asked to rank each question on a five point Likert-scale, with the most positive (strongly agree) scoring 5 and the most negative (strongly disagree) scoring 1.

Phase I of Kaizen entails the analysis and documentation of the current production process, which included work sampling (to measure value added and non value added times) and time study (to document cycle time). The non value added activities (assistance, idle, break, measurement, directions, cleaning, getting tools, getting materials, walking, not available, and inspecting) along with work sampling was performed at 1-minute intervals for each individual worker for the duration of one complete base being assembled. In addition, interviews with the plant manager and line supervisor helped in dealing with current issues and explored possible areas for improvement. The Kaizen event in this study was concentrated on eliminating or reducing production waste.

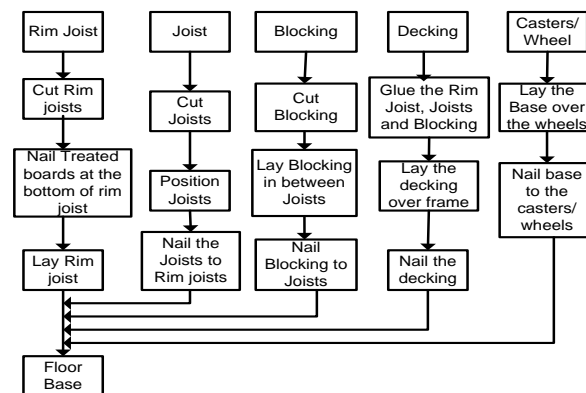


Figure 3: Process flow of base manufacturing at station 1

The base build process includes five major steps: assembling the rim joist, installing the joist and blocking, installing decking, attaching casters, and transporting to the next station (Figure 3). Figure 4 displays the “before” layout of station 1 bordered by six columns out of which two columns support the overhead crane for lifting materials. The base station has iron fixtures for supporting the base frame at one end, and the other end is supported by concrete blocks, and materials are staged around the working area (Figure 4). The tool carts are not placed near to work station and are not displayed in Figure 4.

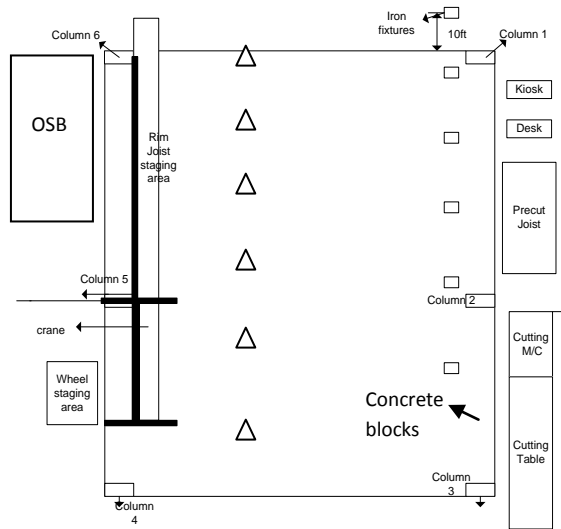


Figure 4. Initial layout of station 1

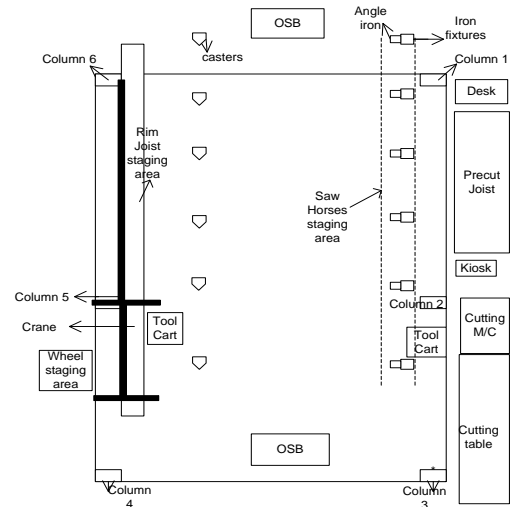


Figure 5. Modified layout of station 1 after Kaizen

Phase II of Kaizen was to implement the changes in the process which was determined jointly with the plant manager, line supervisor and area workers. The improvements included revision of standard procedures through a pre-planning step, station layout redesign (Figure5), and improving staging tools strategy. After implementing improvements time study and work sampling were conducted. After completing the second phase, results from the Kaizen event were presented to the company's managers and station workers (Phase III).

As a part of data analysis, the completed OC questionnaire data was entered into a spreadsheet; each question was recorded in a numerical format. If the worker left any question unanswered, he or she was not included in the analysis that pertains to the blank answer. The OC questionnaire data was analyzed using SPSS® (Statistical Package for Social Science) software. The descriptive statistics (means and standard deviations) of the sample and the workers' responses of each variable defined in the OC questionnaire were calculated.

Results

The result in Table 1 shows the implementation of Kaizen improved the cycle time for process at station 1. Man hours (min) represent the time taken by 5 workers to complete the entire process at station 1. Overall there is an improvement of 55% in the cycle time for the process. Table 2 shows results from the work sampling study with an increase of 16% in value added activities.

Table 1

Time study data for cycle time at station 1

	Before Kaizen	After Kaizen	Improvement
Man hours (min)	952	899	55%
Man hours(min)/ sq ft	2.25	1.02	54.6%

Table 2

Work sampling data for value added and non value added activities at station 1

Activities	Before Kaizen	After Kaizen
VA	41%	57%
NVA	59%	43%

Table 3 shows the results of rating scores for workers from the OC questionnaire. Job satisfaction, commitment, and teamwork showed improvement after the Kaizen event. Stress decreased and communication remained unaffected after the Kaizen event.

Table 3

Descriptive analysis

Variables	Before			After		
	Mean (SD)	Minimum	Maximum	Mean (SD)	Minimum	Maximum
Job satisfaction	3.50 (0.38)	3.00	3.92	3.80 (0.67)	3.08	4.67
Commitment	4.00 (0.59)	3.25	4.62	4.12 (0.33)	3.63	4.50
Teamwork	3.90 (0.59)	3.29	4.71	4.40 (0.66)	3.29	4.86
Stress	3.90 (0.88)	2.57	5.00	3.60 (0.45)	3.14	4.29
Communication	3.40 (0.28)	3.00	3.75	3.40 (0.38)	2.75	3.75

Conclusions and Discussions

As a limitation of the study the average tenure of the workers at the workstation was not recorded, which may have potential to influence the learning ability and the communication factors among experienced and inexperienced workers. Kaizen resulted in improvement for job satisfaction, commitment, teamwork, and stress. Park (2008) concluded that job satisfaction improves with the improvement in teamwork; in our case the descriptive statistics shows the improvement in teamwork as well as job satisfaction. Results for communication were similar before and after the Kaizen event. No variation in communication may be the result of well perception of the assigned role and better understanding of the work before and after the kaizen event, which did not impacted communication during the process. Kaizen showed 55% improvement in cycle time for the base manufacturing process, which means that the crew was able to double production (e.g. two bases per day) , and a reduction of non value added activities of 16% was also recorded. Commitment and teamwork showed improvement after the Kaizen event. Preplanning, preparation, and implementation during Kaizen events have impacted these two factors positively. Similarly, Leung (2008) suggested that proper work life balance and planned work affects commitment and teamwork positively.

Stress decreased which may be the result of reduction in stress due to preplanned or framed procedure of work. Leung (2008) concluded that stress vary with the dynamics of work. During the Kaizen events the process was modified for the purpose of experimentation. The better understanding of the pre planned process and better role perception among the workers to work with new procedure may have led to decrease of worker's stress. Thus, stress may be reduced once workers are acquainted with the new work processes.

Recommendations and Future Research

Based on the results from the pilot study, further recommendations to improve OC include:

1. Communication needs to be more accurate and effective to enhance accuracy of the information and role clarity among the workers.
2. Use mock up trials of the pre-planned process to train workers on the modified process to mitigate job stress.
3. The workload should be distributed evenly among the workers to reduce job stress.
4. Tasks which require precision should be assigned to skilled or experience worker in order to reduce job stress among the inexperienced or unskilled workers.

For future research, more data will be collected to achieve more accurate results. In addition, the average tenure of the workers at the workstation may be collected to analyze its influence on the learning ability and communication factors among new and experienced workers.

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