

AN ABSTRACT OF THE THESIS OF

Zachary J. Fairman for the degree of Honors Baccalaureate of Science in Industrial Engineering presented on May 27, 2010. Title: Evidence of work engagement and its link to performance in lean manufacturing implementation.

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Work engagement is demonstrated when employees are involved with, committed to, enthusiastic, and passionate about their work. The goal of this study was to summarize relevant information on work engagement, produce a working coding system to identify evidence of work engagement, and discuss the implications of work engagement on an organization. An analysis of qualitative data was performed using three sets of data collected from three separate electronic manufacturing companies in the Pacific Northwest. The data were collected when each company was implementing lean manufacturing tools and concepts. The findings indicate a strong relation between evidence of engagement and perceived individual success. Those employees who showed indication of engagement were more successful in their organization and possessed a greater understanding of company practices.

Keywords: engagement, work engagement, organizational culture, job design, working conditions, work environment, job resources, performance, involvement, lean manufacturing

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Evidence of work engagement and its link to performance in lean manufacturing
implementation

by

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1. INTRODUCTION

1.1. BACKGROUND AND SIGNIFICANCE

Work engagement has been recently recognized as one of the most important challenges for management. Work engagement is when employees feel positive towards their work, find their work to be meaningful, consider their workload manageable, and have hope about the future of their work (Attridge, 2009). Work consists of three factors, the physical component, the emotional component, and the cognitive component (Attridge). Company performance is impacted immensely when an environment is created in which employees are engaged in their work.

Dr. T. Doolen, a professor in the School of Mechanical, Industrial, and Manufacturing Engineering at Oregon State University, collected data from three organizations engaged in implementing lean manufacturing tools and concepts. Interviews and observations resulted in a qualitative data set that describes employee viewpoints during the process of adopting lean. This thesis will analyze the data set in order to study the potential role of work engagement to the successful implementation of lean manufacturing tools and concepts.

The motivation for this thesis topic came from a spring and summer employment at a silicon wafer test equipment manufacturing company. The company was going through a rough period and it was noticed that employee morale was down. Business was slow, the company was in the midst of multiple rounds of layoffs, and overall worker attitude was

very negative. The researcher attended a conference over the summer, and employee engagement was the subject of a seminar at the conference. The researcher learned of the connection between engagement and company success. He realized that little evidence of work engagement existed at his current company, and thus began further research. He set out to answer the question: “How does engagement relate to company performance?”

1.2. RESEARCH TOPIC AND FINDINGS

Initially, it looked as though pulling engagement data from existing qualitative lean implementation data would prove to be difficult, but with an appropriate coding system it was feasible. Drawing the correct keywords to suggest evidence of engagement was an important step in the development of the thesis methodology.

Also included in this thesis is a literature review, the specific findings of the analysis completed, conclusions, and recommendations for further research. The literature review was performed to develop a working definition of engagement and to determine how signs of work engagement are best identified. A coding system was developed to analyze the qualitative data set for evidence of engagement.

The goal of this study was to summarize relevant information on work engagement, produce a working coding system to identify evidence of work engagement, and discuss the implications of work engagement on an organization. The connection between lean manufacturing and engagement is very important. Lean manufacturing refers to a technique that involves removing waste from any manufacturing system. In order for any

company to best lean out their organization, the employees must care about their jobs and the company's efforts.

2. ENGAGEMENT LITERATURE REVIEW

Many of the papers reviewed were chosen because of their coverage of measuring and managing engagement effectively and work engagement and its link to performance. Some of the keywords used in the literature search included engagement, work engagement, performance, work environment, work culture, measurement, participation, involvement, and management. After an extensive review of the research papers it was determined the selected articles provide sufficient information to establish a background for this study.

2.1. INTRODUCTION

Kahn (1990) introduced the concepts of personal engagement and disengagement. He based his work on linking previously conceptualized concepts to personal performance. Since then, engagement at work has emerged as an important topic within employee performance and organizational management. Knowledge of the subject now supports the relationship between employee engagement and various organizational outcomes, including those which are performance based (Simpson, 2008). Only 29% of employees, however, are actively engaged in their jobs, 54% of employees are not engaged, and 17% of employees are actively disengaged (Seijts & Crim, 2006).

Personal engagement was originally defined as the behaviors by which people bring in or leave out their personal selves during work role performances (Kahn, 1992).

Employee engagement was further used to describe the extent to which employees are involved with, committed to, enthusiastic, and passionate about their work (Macey & Schneider, 2008). Another relevant definition of work engagement is when employees feel positive emotions towards their work, find their work to be personally meaningful, consider their workload to be manageable, and have hope about the future of their work (Nelson & Simmons, 2003). The four areas of work engagement to be studied and the factors that contribute to each are found below.

2.2. JOB DESIGN

Job design plays an important role in the engagement of employees. Not many companies measure engagement, but there are tools that have been developed to do so. The Utrecht Work Engagement Scale (UWES) measures three areas of work engagement corresponding to themes of vigor, dedication, and absorption in one's work (Attridge, 2009). Aligning tasks to interests can lead to satisfaction and thus improve work engagement. Emotional vigor was found to be essentially important in explaining why employees give effort at work. It is important to strike an appropriate balance. Burnout and emotional exhaustion can take place if work is too emotionally demanding.

Three psychological conditions, meaningfulness, safety, and availability, were found to impact an individual's level of engagement at work (Kahn, 1990). When employees have high levels of control, reward, and recognition in their position they will be more engaged (Koyuncu et al., 2006). Aligning these attributes to specific positions is vital

in creating an environment that fosters engagement. For example, if a certain task is more difficult, those that are expected to perform it should receive more reward for their effort. More generally, research indicates that jobs characterized by high job strain often can result in poor worker productivity (Attridge, 2009).

2.3. JOB RESOURCES

Job resources refer to those physical, psychological, social, or organizational aspects of the job that may reduce job demands. Resources are functional in achieving work goals, and stimulate personal growth, learning, and development. On the contrary, lack of job resources have negative effects such as increased levels of burnout. Hakanen et al. (2006) identified five job resources that increased engagement, or that, when lacking, act as factors that increase burnout: job control, access to information, supervisory support, innovative climate, and social climate.

Poor job resources are directly associated with burnout and are indirectly associated with lower levels of work engagement (Hakanen et al., 2006). Hakanen et al. showed that those who are able to draw upon job resources like job control, supervisory support, and innovativeness may become more vigorous and dedicated (i.e., engaged in their work and may feel stronger commitment). On the other hand, a lack of important job resources to meet the job demands may be associated with burnout, which may further undermine work engagement and lead to lower organizational commitment (Hakanen et al.).

A company can do many things to foster work engagement. Engaged employees are committed to an organization because the organization provides them with job resources that not only enable them to achieve their work goals, but that also provide opportunities for learning, growth, and development (Houkes et al., 2001). Organizational support can come in the form of supervisor support, positive appreciation, collaborative organizational climate, innovative problem solving, employee assistance programs, educational/training programs, and various other employee services.

2.4. WORKING CONDITIONS

Working conditions refer to the conditions pertaining to workers' job environment, such as hours of work, safety, paid holidays and vacations, rest periods, free clothing or uniforms, possibilities of advancement, etc. (Hakanen et al., 2003). Three aspects of working conditions have been identified as major causes of psychological strain: disruptive pupil behaviors, work overload, and a poor physical work environment (Hakanen et al.).

Organizations should attempt to avoid creating difficult job demands and stressful working conditions. These factors are the main predictors of employee burnout (Attridge, 2009). Removing problematic parts of job tasks, adopting more ergonomic workplace equipment, adding flexibility to work schedules, improving role clarity, improving decision-making authority, and fostering opportunities for positive social relationships at work are all things that can be done to improve working conditions and positively affect work engagement (Warr, 2005).

One aspect of working conditions is management span of control. The Gallup Work Audit conducted a study, as found in Cathcart et al. (2004), which explored the relationship of engagement and manager span of control. Study results suggest that engagement is higher when unit managers' span of control is lower. Positive increases in work engagement were found through decreasing four managers' span of control by 30-50%.

2.5. ORGANIZATIONAL CULTURE

Five factors have been found to be vital in contributing to a healthy workplace culture: supporting work-life balance, fostering employee growth and development, encouraging health and safety on the job, praise and recognition, and employee involvement/engagement (Grawitch et al., 2006). Certain management principles can also facilitate community-building efforts in organizations (Attridge, 2009). Some of these principles include having a compelling company vision, creating guidelines for decision making that are based on principles and ethics rather than on rules and punishments, and enacting assimilation strategies for new staff so that they can understand the culture of the organization.

The climate created by company leaders plays an important role in work engagement. A negative social climate created within an organization can lead to burnout (Hakanen et al., 2006). A healthy leadership style provides a clear vision, inspires and motivates, offers intellectual challenges, and shows real interest in the needs of the

workers. This style of leadership can be defined as transformational leadership (Barling, 2007). Showing emotional competence with others is another important attribute of leadership (Quick et al., 2007).

2.6. DEFINITIONS

Table 2.1. Constructs and definitions of work engagement

Construct	Definition
Work Engagement	Work engagement is when employees feel positive emotions towards their work, find their work to be personally meaningful, consider their workload to be manageable, and have hope about the future of their work (Nelson & Simmons, 2003). Work engagement is characterized by vigor, dedication, and absorption. Vigor is characterized by high energy and mental resilience while working. Dedication means being strongly involved in one's work and experiencing a sense of significance, enthusiasm, inspiration, pride, and challenge. Absorption is characterized by being concentrated on and happily immersed in one's work (Simpson, 2008).
Burnout	Burnout is a psychological syndrome experienced in response to chronic job stress. It is characterized by emotional and physical exhaustion, low involvement, and inefficacy (Maslach and Leiter, 1997).
Meaningfulness	Psychological meaningfulness is a personal return on investment in work role performance.
Safety	Psychological safety refers to being able to employ oneself without fear of negative effects to one's self image or status at work.
Availability	Psychological availability refers to possessing the physical, emotional, and psychological attributes needed for investing oneself in a work role.
Job Strain	Psychologically demanding work coupled with little opportunity to make decisions or use personal skills
Working Conditions	Working conditions refers to the conditions pertaining to workers' job environment, such as hours of work, safety, paid holidays and vacations, rest periods, free clothing or uniforms, possibilities of advancement, etc.

2.7. CONCLUSION

A study conducted by Harter et al. found that four elements must be present for engagement to occur within the workplace. These elements include clarity of expectations and basic materials being provided, feelings of contribution to the organization, feeling a sense of belonging to something beyond yourself, and feeling as though there are opportunities to discuss progress and growth (Harter et al., 2003).

People that are actively engaged tend to help move the organization forward, while disengaged employees undermine what their co-workers are trying to accomplish (Seijts & Crim, 2006). To further illustrate this disparity, 84% of engaged employees believe they can positively impact the quality of their organizations products, compared with only 31% of the disengaged (Seijts & Crim).

3. METHODOLOGY

3.1. QUALITATIVE RESEARCH

Qualitative research is research that involves analyzing and interpreting text, often resulting from interviews or observations in order to discover meaningful patterns descriptive of a particular phenomenon (Auerbach & Silverstein, 2003). Data that cannot be analyzed quantitatively can usually be studied through observation. In order for such a study to be successful, qualitative research methodologies must be applied. Qualitative data is expressed in sentences, and rarely has number values attached whatsoever.

Qualitative research is commonly criticized for its resulting non-exact data, but with the proper techniques this subjectivity can be avoided. Because of its method, qualitative data can be described as thick description (Worley, 2004). Because of this, those reviewing the results of the research are allowed the opportunity to understand the context of the research and evaluate the interpretation of the data for themselves (Patton, 1990).

Qualitative research methods allow in-depth exploration of complex relationships between variables that are both qualitative and quantitative (Worley, 2004). It is more difficult to generalize, but studying naturally occurring, ordinary events in natural settings offers a perspective on “what real life is like” (Miles & Huberman, 1994). For this research, data was collected using three methods: interview, observation, and review of existing company documents and publically available information from the worldwide web. The qualitative researcher must use techniques, such as multiple sources for data collection

and triangulation to increase the robustness of the research. Triangulation occurs when multiple sources from different data collection methods support the same conclusion or, at the least, do not contradict a conclusion (Miles & Huberman, 1994).

3.2. VARIABLES

Each variable that was used in data analysis was established based on a review of related research literature. Because a variety of research has been previously conducted, multiple definitions and contexts were found for each variable. In order to best apply these variables to this study, operational definitions were developed for each variable and these variables were used in the analysis of the data.

The four variables used in this study were job design, job resources, working conditions, and organizational culture. Job design refers to the specific attributes that make up one's daily tasks. Job resources refer to any program in place at a company that may reduce job demands, are functional in achieving work goals, and stimulate personal growth, learning, and development. Working conditions refer to the conditions pertaining to workers' job environment, such as hours of work, safety, paid holidays and vacations, rest periods, free clothing or uniforms, and possibilities of advancement. Organizational culture refers to what an organization does to support a work-life balance, foster employee growth and development, encourage health and safety on the job, praise and recognize performance, and promote employee involvement/engagement.

3.3. STUDY SITES

An important aspect of conducting qualitative research is understanding the organizations being studied. This background information is also useful if other researchers would like to replicate the findings of the study. Three electronics manufacturing companies participated in this study. Each company was located in the Pacific Northwest. The identity of the companies was kept confidential. In this study, the companies are referred to as CompA, CompB, and CompC. Contact was made with organizational leaders and members of each case study sites as part of a larger research project funded by the National Science Foundation (NSF) and directed by Dr. Toni Doolen, PhD of the School of Mechanical, Industrial, and Manufacturing Engineering at Oregon State University.

CompA features a full laboratory which offers its customers assistance a wide variety of service areas, including testing, engineering, consignment, turnkey systems, systems integration, and rework and repair. It has a presence in many different industries including semiconductor equipment, telecommunications, medical instruments, measurement instruments, aerospace, supercomputers, and others. CompA has stayed successful through experienced employees, ongoing training programs, and streamlined design and manufacturing processes.

CompB is a customer-driven company. It relies on input from its customers to continue its success. It holds the philosophy that its success comes from its experience. CompB offers services within telecom systems, testing and measuring instruments, medical imaging, diagnostic products, and more. It has a wide range of connections and influence

within the high-tech industry, which also contributes to achievement. Benefits to partnering with CompB are their technical resources, deployment skills, achieving a faster time-to-market, and reduction of development risk and cost.

As far as CompC is concerned the most important aspect of a successful business is “[k]nowing your customer. Know their needs and make it your purpose to solve those needs on a daily basis.” CompC has lived by this philosophy for 40 years. Their services range from electronics engineering, design, and manufacturing, SMT prototyping support, production test development, and production material management. CompC prides itself on an outstanding quality record.

3.4. DATA COLLECTION AND ANALYSIS

Data collection was conducted in three phases, and the management and analysis of the resulting data was divided into two phases. Phase one consisted of formal interviews. Phase two involved observations and unstructured interviews with line employees, support personnel, clerical staff, and senior management. Phase three consisted of the analysis of manufacturing production data, which provided a background for the research and allowed the researcher to provide suggestions for improvement within the organizations. Phase four involved transcription of the notes. Phase five involved the actual coding of the data into its appropriate units, entering the coded data into the database, and performing preliminary analysis. Some of the data were then re-coded to further refine the data into the most meaningful unit of analysis as possible.

3.4.1 Data Sources

In order to achieve triangulation data must be collected by different methods and/or from different sources. For this reason, the data source and method by which the data was collected were both tracked throughout the study. Employees who participated in the research did so voluntarily, without any imposed consequences or monetary compensation. All interviews were conducted following a detailed protocol, which was approved by the Oregon State University Institutional Review Board (IRB). All employees were ensured of the voluntary nature of their participation and the steps taken to protect the confidentiality of their responses. Each participating individual was assigned an identification code to assist in triangulation and to ensure confidentiality. Each employee was assigned a letter of E or L followed by a unique number. An E was used to designate a supervisory or managerial employee. L was used to designate a non-supervisory employee.

3.4.2. Data Collection

The purpose of an interview is to allow the researcher to “see into” the interviewee’s perspective and to collect information that is not available through direct observation (Patton, 1990). A structured interview is defined as a set of specific questions (Patton). An interview protocol may resemble a questionnaire, but the verbal interview

format generally allows for more flexibility. To be most effective, the tone of the interview should be conversational and questions should be open-ended.

Researcher's opinion must never create biased information. It is important that interview questions be structured such that no implications of researcher opinions are present (Lofland & Lofland, 1995). It is critical that the interviewer does not try to sway/influence the interviewee. The interviewer must attempt to record the data without reservation (Patton, 1990). Influence can come in the form of body language. The interviewer must be very careful to control reactions or other behaviors that might project their own viewpoints, throughout the entire study.

Two sets of formal interview questions were developed for this research, one for executive or managerial personnel and one for non-supervisory employees. The managerial questions were designed to seek out information on the lean implementation from a strategic viewpoint. The non-supervisory questions focused on the impact of the implementation specific to the employee's work area and from the employee's view of the transition. The interview instruments for executive personnel and non-supervisory personnel are included in Appendices A and B, respectively.

During observations, unstructured interviews also took place. Unstructured interviews and observations of employees provide information about the participant in their natural environment. An unstructured interview relies on the spontaneity of the situation and allows the interviewer to generate questions as part of an observational situation (Patton, 1990). The data that is gathered from an unstructured interview will vary from subject to subject as no formal framework is in place (Patton).

Observations may allow the researcher to collect data that interviewees might be unwilling to discuss during an interview (Patton, 1990). Speaking with a participant in a more social setting can increase the comfort level and thus lead to more open and honest responses. Observations may also lead to the collection of pertinent data that has become so routine that the employee would not think to discuss it in a more structured setting. One perspective problem of observation is the considerable amount of data that is collected, which can lead to a problem in data analysis and resource allocation (Patton).

Documents (consisting of letters, memos, meeting minutes, proposals, etc.), provide a rich source of information that the researcher can use to more fully understand an organization (Patton, 1990). Documents offer the advantage of being a stable data source that can be reviewed repeatedly without worry that the data will change (Yin, 1994). It is critical, however, to remember that most organizational documents were not created for the purpose of a study and instead offer information created for a specific dissimilar purpose (Yin).

3.4.3. Data Analysis

During interviews and observations field notes were taken. These notes do not reflect all of the content of the structured/unstructured interviews or observations. The transcribing process allows for important content to be added to the notes as the interviewer remembers specific information they did not write down. It is important to have complete

information, so small details may also be added during the transcription process in order to complete unfinished thoughts from the data collection phases.

Codes are commonly created from the conceptual framework, the hypothesis, or the research questions (Miles & Huberman, 1994). Due to the sheer amount of data collected over the course of the study, the analysis was broken down into two phases. First, a detailed analysis was done on the data to obtain specific information. The detailed analysis consisted of breaking down the data point by point for specific information. One line employee and one supervisor were chosen from each company at random to be analyzed. A Microsoft Excel macro was used to select employees who were to be initially screened. Only line employees were interviewed at CompB, so a supervisor was not included in the detailed analysis. Notes from the detailed analysis were collected and summarized by variable. Conclusions were then drawn from this analysis before continuing on to the next phase.

Once the detailed analysis was concluded, a search analysis of all the data was conducted. The word frequency search analysis was a technique, which consisted of doing a keyword search on each data set. Keywords were originally developed from the literature review and broken down by variable. During the detailed analysis keywords that were believed to be relevant were added to the list of those to be used in the word frequency analysis. All keywords used in this analysis can be found in Table 3.1. Many of the keywords are classified under multiple variables. The words that were added as a result of the detailed analysis are emboldened. This analysis was designed to identify the relevant information while minimizing the time needed to sort through the entire data set. Because

the word frequency analysis was interested only in aggregate results, findings were classified solely as either an E employee response or an L employee response.

Table 3.1 – Keywords used for search analysis

Variable	Keyword
Job Design	Task, Interest, Satisfaction, Difficulty, Focus, Expectation, Meaningful, Safety, Availability, Rewards, Optimism, Burnout, Exhaustion, Prepared, Variance, Control, Stress, Performance, Benefits, Resistance, Simple, Reduce, Efficient, Results
Resources	Support, Tired, Service, Control, Training, Opportunity, Program, Assistance, Event, Kickoff, Implement, Safety, Structure, Class, Literature, Access, Incentive, Information, Appropriate
Working Conditions	Environment, Flexibility, Communication, Honesty, Knowledge, Listen, Encouragement, Policy Involvement, Goodwill, Stress, Assistance, Accountability, Structure, Involve, Broad, Buy-in, Attitude, Results, Positive, Initiative, Micromanage, Expectation, Discipline, Motivation, Understanding
Organizational Culture	Balance, Values, Growth, Development, Health, Recognition, Involvement, Engagement, Encouragement, Disconnect, Incentive, Positive, Motivation, Support, Culture, Help, Career, Progress, Morale, Connect

3.5. CONCLUSION

Due to the nature of qualitative research it is necessary to spend considerable time developing the methodology to guide data collection and analysis. Most engineering research focuses on numbers and quantitative measures. The author encountered a steep learning curve when confronted with the vastly different arena of qualitative research. One

factor that made data analysis easier was the level of organization that was applied to the data in collection.

Many different data collection methods were utilized over the course of the study. This diversity was important in ensuring the validity of the findings. Case study site information has been compiled to provide the appropriate context for the remainder of the analysis. It was found that the subject classification system played a substantial role in organization and clarity of the data. The research findings and the detailed results from the analysis are presented in the next chapter.

4. RESEARCH FINDINGS

The analysis of the company data revealed interesting patterns. Some of the findings demonstrated evidence to support further research. Some of the results were as expected and some were not. The data set contained many segments that could be categorized under multiple variables. Specific evidence will be provided when discussing each variable.

In order to ensure confidentiality, each employee was assigned a letter of E or L followed by a unique number. An E was used to designate a supervisory or managerial employee. L was used to designate a non-supervisory employee. E6 and L14 were randomly chosen from CompA for the detailed analysis. L5 was chosen from CompB for the detailed analysis. E3 and L5 were chosen from CompC for the detailed analysis. Each of the variables and findings are discussed next.

4.1. JOB DESIGN

4.1.1. Job Design Factors Found from Detailed Analysis

The E6 employee at CompA stated that only E employees were able to give input on improvement ideas and perceived problems, L employees “[we]re just told they will do it.” CompA attempted to involve a cross departmental team representative of all employees for new practice implementation, but usually was not successful. E6 attributed most

negative issues to job design, including not being prepared, communicating with right people, and not having appropriate information to complete a task. E6 believed hands-on experience is the biggest thing lacking in job design due to the variance in each job responsibilities. L14 showed a higher understanding of these concepts.

L14 at CompA had good grasp of marketplace demands and implications of demands on job. L14 understood reasons for tasks largely considered unnecessary by other L employees. L14 seemed to have a deep understanding of some of the aspects of the company that were not lean and could easily be improved. L14 even went as far as describing “funnel” effect that slows down production, also known as a bottleneck. L14 believed job design of planners make it hard for them to be successful – they did not review accounts outside of their own and thus did not know how to properly forecast due dates to customers, creating poor performance and job stress. CompB offered a different perspective.

L5 at CompB believed the company was managed poorly and relied on L5’s and other L employee talent to stay in operation. L5 “[did not] feel like participating in lean” so did not care enough to answer questions about the differences in L5’s job description as a result of the lean manufacturing implementation. This employee displayed a very low level of care in respect to job design. The employees at CompC provided more effective responses.

E3 at CompC believed that with respect to the lean implementation, jobs were not designed around specific goals, which delayed perceived benefits and performance increases. These factors aided in the support of the lean initiative and encouraged employees to stay excited about company changes. E3 recognized the importance of cross

functional implementation teams. E3 was active in job design and was able to pursue own interests when appropriate. L5 offered similarly useful information.

CompC's L5 saw noticeable improvements from lean implementation. This resulted in the "simplification and speediness of some mundane tasks." These improvements increased job satisfaction. L5 noticed a resistance to change in job design from many employees, but L5 welcomed the change.

New keywords established from the detailed review of job design were: prepared, variance, control, stress, performance, benefits, resistance, simple, reduce, efficient, and results.

4.1.2. Job Design Factors Found from Word Frequency Analysis

E employees at CompA expressed a lack of follow through when it came to new job design recommendations, stating "they [went] at it with a vengeance at first, and then los[t] interest as another new idea [came] along." E employees noticed improvements in the layout of the facility, the work flow, and overall employee morale as a result of the lean manufacturing implementation. A re-occurring theme conveyed by E employees was the difficulty of managing change in job designs. As stated by E employees, the quality team expected more attention to detail from the operators than what was currently being provided. E employees felt more control of specific job design had been established over the last couple years, which resulted in faster-paced adoption to change. "When a new practice [was] under less department control it [was] harder to get the input needed."

Generally, machine centered projects ran into less resistance than people centered projects when it came to trying to increase efficiency. E employees stated it was hard to sell an idea that required a change in job design as a good thing if that idea came from management. E employees, however, noted that L employees “[did not] always have the time luxury to look at ways to become more efficient.” This represented a dilemma for E employees who looked to improve L employee’s job designs.

L employees at CompA understood that “waste reduction [was] a goal of lean manufacturing” and noted that efficiency in job tasks was crucial to company success. When asked about running an efficient business, L employees expressed knowledge of the downfalls of rework and the importance of customer satisfaction. One L employee felt contracting with a person outside the company may be important in constructing job tasks. This outside contractor would provide an unbiased perspective. L employees noticed their input was not valued enough when it came to making decisions and introducing new ideas, stating directly “management [was] not open to ideas from the floor.”

CompB cross-trained all its employees, which led to job satisfaction. One L employee expressed that the lean implementation had eliminated much job design-related stress, while another stated it had brought on the added “stress of doing something new.” An L employee stated “[t]he tasks where we [could] see real benefits on a moment-to-moment basis [were] more successful,” stressing the importance of acknowledgment. L employees expressed understanding of lean manufacturing as a way “to reduce carrying costs and better support customer requirements.”

As a result of the lean implementation at CompC, jobs became specifically designed to maximize customer satisfaction. L employees recognized that initially getting employees

to change their habits was difficult, but once the benefits of the changes were realized employees embraced the changes. L employees noted the minimization of inventory, improvement of facility layout, work flow, and company efficiency due to the lean implementation. Use of operator cross-training was also believed to have helped streamline company processes.

4.2. RESOURCES

4.2.1. Resource Factors Found from Detailed Analysis

CompA's E6 response was limited with regard to resources. E6 simply stated that no resources were allocated for implementation. Employees felt discounted by this lack of support. No kickoff event, training, or future state discussion was done. The L14 interview yielded similar results.

L14 at CompA received no lean manufacturing training at company prior to implementation. L14 previously worked at another company that had some training programs in place, but other L employees at CompA did not share this knowledge. Many L employees felt blind going into implementation and did not feel the efforts were having positive effects. A lean training program would have been very helpful. L14 stressed the importance of proper training programs throughout interview. L14 stated that the only defined resource was engineering support. Unless it was needed to do the work or

considered required for safety purposes, little else was provided by company. From the initial analysis of L5 at CompB, CompB appeared to also lack structured resources.

L5 at CompB L5 stated that no lean training was provided whatsoever prior to implementation. This led to L5 not knowing when implementation actually began. As noted by the interviewer, this seemed to contradict popular belief by other L employees. Other L employees interviewed stated there was a class conducted which was very helpful in going over the basics of lean and CompB's lean implementation strategy. This disconnect between L5's view and that of other L employees suggested that L5 might be disengaged. L5 believed that there were never appropriate training programs for any new processes. L5 declared no appropriate systems were in place to adequately support L5. For example, when a problem with a product was encountered L5 was reprimanded by engineering for not following procedure, but was belittled by operators when procedure was followed. CompB implemented an operator of the week award which increased morale and made individuals aware of when their actions cut down on inventory and operational costs. The detailed analysis of CompC provided a more positive view of the lean implementation.

E3 at CompC stated that before lean implementation, access was given to literature on lean manufacturing and a class was offered to go over the basics of lean manufacturing. E3 believed that the lean implementation team made themselves very approachable to anyone who had questions. The company offered an incentive program to those that became heavily involved with the lean implementation. Results from L5 at CompC appeared similar.

CompC's L5 stated that not all employees attended the lean training first-hand, but those who did brought back information and materials to share with others who did not attend training. A more extensive training program would have been helpful in explaining some of the changes that the lean manufacturing implementation would result in and benefits from those changes. L5 understood the company's hesitation in conducting company-wide training and believed the strategy the company chose was effective in relaying appropriate information.

New keywords established from the detailed review of resources were: event, kickoff, implement, safety, structure, class, literature, access, incentive, information, and appropriate.

4.2.2. Resource Factors Found from Word Frequency Analysis

E employees at CompA reflected on the importance of training programs in case they chose to leave the company, but felt there was not a whole lot of internal training. Limited off-site seminars had been offered in the past for E employees.

Some L employees at CompA expressed that usually the only training device was a document that discussed a new idea, a new goal, and target dates. After reading these documents L employees were expected to have an in-depth understanding of the new processes. L employees felt, however, that safety training was always provided, but because of a limited training budget, most other support systems were cut. On the contrary, a limited number of L employees stated they attended seminars, attended night classes,

attended internal education programs, been given books to read, and felt supported by the training offered by the company.

An L employee at CompB noted that training sessions, brainstorming, and group discussions were offered in preparation for the lean implementation. Another employee stated a lean committee was formed which had direct access to an abundance of materials and was always open to answer any questions any employee had. The general consensus among L employees was that ample training sessions and information were made available prior to lean implementation. The material manager tried to ensure that all employees be impacted by a new process be involved in the preparation and support system of the process. L employees mentioned, however, it would have been helpful to have been involved earlier in the process.

One E employee at CompC stated that the training that existed was only available to management and the “trickle down” affect was relied on for the passing on of information. On the contrary, another E employee stated that employees were sent offsite for kaizen events training and the company hosted one lean training event. The management was “very supportive in making training available to employees.” Cross training was utilized as a “better use of downtime for training and utilization.”

L employees at CompC did not attend training classes. The general thought was that taking classes would have been unnecessary and relying on information from management and shift leads was sufficient.

4.3. WORKING CONDITIONS

4.3.1. Working Condition Factors Found from Detailed Analysis

E6 at CompA stated that efficiency was not the driving force of change. Internal competition was. E6 believed that engineering attempted to get line employees more involved. E6 saw noticeable benefits in L employees from such efforts. E6 deemed this non-measurable attribute as “goodwill.” Dissimilarly, L14 offered extensive information on working conditions.

CompA’s L14 felt the company did a good job with flexibility with their role in the company. L14 enjoyed having such a broad job description. There was no formal schedule established when implementing a new idea or practice. L14 deemed poor planning as “the frustration in today’s marketplace.” L14 knew that in order for a practice to have been successful it must have had “buy-in” from all employees involved in practice. L14 stated the importance of disciplined attitude when it came to improvement efforts and initiative results. L14 stressed the need for management to encourage ways to foster efficiency in company working conditions. L14 felt open communication, proper tooling, and a positive emotional tone were all vital in success. L14 stated that all three of these attributes were present in the lean implementation, which improved results. L14 believed there was too much micromanaging going on and that employees needed to take a greater initiative in order to eliminate the need to be monitored all the way through a process. There was no tool at Comp A to appropriately schedule due dates or to communicate progress of an

order. The lack of this tool resulted in lack of communication to customers about order progress and whether or not an order would be filled by a targeted due date. L5 at CompB had a differing perspective.

L5 at CompB stated the Comp B was not flexible and had too high of expectations of L employees, which led to a disconnect between L and E employees. L5 believed that no communication existed and lean tools were implemented with no warning or explanation of their purpose. In L5's eyes this lack of communication extended to all new programs the company instituted. L5 blamed the "failure of lean" to a lack of communication about the implementation. The initial analysis of CompC yielded more optimistic results.

E3 at CompC stated that there was a perceived disconnect between data collection and measurement. Making this connection would have been helpful in improving communication flow between different areas of the company. E3 stated that programs worked better when they were focused more on accountability and less on self-supervision. E3 stressed the importance of honesty in communication between E and L employees in order to most accurately gauge effects of lean implementation. L5 at CompC expressed similar feelings.

CompC's L5 noticed communication in inventory process could be more efficient, which would have resulted in a better inventory management and decreased downtime, thus increasing productivity and morale. L5 noted "better management engagement with the floor" as a perceived benefit of the lean manufacturing. L5 expressed that "on the floor" there was a positive feeling towards management due to the level of understanding the L workers had of the decisions management made.

New keywords established from the detailed review of working conditions were: structure, involve, broad, buy-in, attitude, results, positive, initiative, micromanage, expectation, discipline, motivation, and understanding.

4.3.2. Working Condition Factors Found from Word Frequency Analysis

A CompA E employee noted the effectiveness of the “flat structure” of a specific department within the company. “Because [the organizational structure was] so flat, everyone wore multiple hats. There was more involvement, and they were much more successful.” Many other E employees noted that there were more successful practices when there was more organization-wide buy in and involvement. Company-wide buy-in was very important. E employees noted the importance of stopping a problem or negative attitude immediately and controlling the negative effects felt by other parts of the company.

CompA L employees noted the importance of being flexible and accepting changes in working conditions. L employees stated that due to layoffs “people [were] tired and disenchanted, which affect[ed] productivity.” A lack of discipline in the working environment caused a lack of buy-in from L employees. L employees noted the improvements of worker environment due to the layout changes brought on by the lean implementation.

L employees at CompB understood the improvement-effect lean had on conditions. Lean has been met with supportive attitudes. This differs heavily from initial findings from the detailed analysis, and will be discussed further. An electronic suggestion box was used

to foster new ideas throughout company. The program was used extensively for a few months and then forgotten. Similar to many L employee accounts, one directly stated that the lean implementation allowed employees at CompB to “build strong teams in a friendlier environment.”

CompC E employees noticed an increase in employee interest in what the company did as a result of the lean implementation. Communication was constantly stated to be a benefit of the lean implementation for E employees. Accountability was improved with the implementation of a kanban system. The kanban system was successful because it did not rely on self-discipline. Employees utilized it more because they were reprimanded if they did not.

CompC L employees recognized that meaningful feedback loops were created over the course of the lean implementation. L employees appreciated the lean implementation as it allowed them to bring a radio to listen to music, gave them more control over their own space, and gave them a greater sense in pride in their work area. All of these factors went into the overall improvement of employee working conditions. One L employee identified these benefits from the lean implementation: “[g]rowth in people, greater sense of pride, and learning of cooperation.” An L employee specifically identified “better feeling of management engagement with the floor” as a result of the implementation.

4.4. ORGANIZATIONAL CULTURE

4.4.1. Organizational Culture Factors Found from Detailed Analysis

CompA tried implementing a program to get input from all employees at the company. The company set up collection systems in an attempt to gain information from all aspects of the company. The program lasted about three weeks before the action team became too busy to respond to items submitted. E6 wanted to see more closure on improvement projects so that contributing employees could have gotten the recognition they deserved. L14 expressed more enthusiastic results.

L14 at CompA attributed lab successes to “the staff.” L14 had a very positive attitude towards the culture of CompA. L14 looked actively for ways to improve the company, but mentioned it had recently become a company-wide policy to encourage such initiative. L14 believed that the entire team was encouraged to look for improvements within company. L14 stated that the company culture was changing in a positive way in regards to the importance of hitting target dates set forth for customers. L14 felt it was the general consensus of the L employees that their ideas were supported. If E employees believed something was a good idea management acted on it. L14 noted that management did have a history of not realizing that personal lives come first for employees. According to L14 “management must realize the importance of work-life balance.” As previously noted, L5 at CompB had a much more negative outlook.

CompB's L5 had a very negative view of company culture. L5 had been in same position for a long time, and had not progressed in their career. Due to this and other factors, L5 displayed an obvious lack of involvement and engagement. L5 believed the company did nothing right and "relie[d] on L5's talent to stay in business." L5 was asked a specific question about lean manufacturing and responded with an abundance of unrelated information about the poorness of the company. If nothing else, L5 agreed to take part in the interview to vent their frustration with the company. CompC interviewees expressed more positive results.

CompC's E3 believed that the company had a customer driven culture which drove change in the organization. Senior management encouraged pride in work and constant improvement. Many employees were very excited about lean implementation efforts, which resulted in "improved morale" and involvement. CompC's L5's results were similarly encouraging.

L5 at CompC believed the company culture encouraged everyone to become involved in the implementation. L5 noted increased involvement in L employees due to connection with management during lean implementation.

New keywords established from the detailed review of organizational culture were: disconnect, incentive, positive, motivation, support, culture, help, career, progress, morale, and connect.

4.4.2. Organizational Culture Factors Found from Word Frequency

Analysis

E employees at CompA noted that the company used a “bottom-up” management system, and upper management only got involved if they needed to. The style fostered new ideas and involvement throughout company. Another E employee noted an “idea work[ed] great when it ha[d] top management support, but [did] not otherwise.” E employees blamed lack of structure in improvement efforts as “their downfall.” An E employee negatively noted that there were two separate distinct cultures within the company – the salaried and the floor. New ideas were fostered within the salaried population, but those on the floor were just told what to do.

L employees at CompA noticed a lack of performance recognition. One employee “generated their own performance requirements” and would keep track of them internally as a source of personal pride. Another went as far as to say no recognition was given and employees are “taken for granted.” It was widely noted by both E and L employees that no incentive program was installed during the lean implementations. Such a program would have raised involvement, increased performance results, and increased employee morale.

As recognized by an L employee, many different attributes were monitored to determine employee performance at CompB. Among the attributes monitored were quality, attendance, and availability. Continuous improvement teams were established at CompB, which did a great deal to improve the company culture. When on the team, L employees felt more valued and were more open to sharing their ideas (“It [was] neat to be in a room

and actually have people listen to you. On the floor there [was] more of a hierarchy – the engineers/techs just brush off what you [said] because you [were] just an operator. In the room everyone [was] treated as an equal.”). A motivation program was set up for L employees at CompB. It had employees aware of inventory costs by implementing an “Operator of the Week” award. “Mandatory fun” events, such as required bowling, offered each quarter “[kept] morale up and [kept] fun in the team.”

CompC had recently restructured their organization, giving more freedom to shift leads (i.e. conducting performance reviews, vacation scheduling, department prioritizing, etc.). Implementation had fostered a more open relationship between management and operators. Management was more willing to listen, more open in communication, and easier to approach and discuss improvement ideas with. Incentive-based pay was offered as a bonus for line workers who participated in lean efforts. There were multiple L employee accounts of morale improvement as a result of the lean implementation.

5. CONCLUSION

The conclusions drawn from the research findings section are summarized next. As a result of this study, there was evidence that engagement did lead to more success at work. Evidence of engagement was more obvious in some employee’s interviews than in others. It was also found that disengaged employees exhibited outward signs of disengagement and possessed a negative attitude towards employment in general.

Table 5.1 summarizes the evidence related to engagement from each analysis. The table is broken down by each component of engagement, by company, and by employee type. As previously discussed, no E employees at CompB were interviewed. Evidence of engagement was found in all three organizations, related to each of the factors, and was noted by both E and L employees. The challenge noted across companies and employee types was in converting individual engagement to company-wide engagement.

Table 5.1. Evidence of engagement

		Detailed Analysis			Word Frequency Analysis		
		CompA	CompB	CompC	CompA	CompB	CompC
Job Design	E Employees		-	X	X	-	X
	L Employees	X		X	X	X	X
Resources	E Employees		-	X		-	X
	L Employees			X	X	X	
Working Conditions	E Employees	X	-	X	X	-	X
	L Employees	X		X	X	X	X
Organizational Culture	E Employees		-		X	-	X
	L Employees	X		X		X	X

5.1. CONCLUSIONS FROM RESEARCH FINDINGS

A dilemma was uncovered at CompA. E employees identified that it was difficult for L employees to adopt changes in their job when instructed to do so by management. But, L employees were not given sufficient time to come up with improvement ideas themselves. In this situation, a compromise must be reached in order to effectively implement improvements. One potential solution would be to create a team consisting of both E and L employees. This would give management a chance to implement policies while allowing E employees to be engaged in the process and take ownership of the results.

Lack of proper training programs was the subject of much displeasure at CompA. Most employees felt the company did not invest enough effort in preparing employees for and supporting employees during new concept implementation. The lean implementation was no different and signs of disengagement were evident in the detailed analysis of both the E employee and the L employee. Employees at CompB, however, were very happy with the training programs at their company and showed signs of higher job satisfaction because of the training. CompB cross-trained all its employees, which improved job satisfaction. Cross training allowed balancing of employees to alleviate bottlenecks.

L5 was the representative randomly chosen from CompB for the detailed analysis. L5 constantly responded negatively to all questions asked during the interview. The word frequency analysis, however, of CompB did not yield any further evidence to support any of L5's claims. This was a large disparity. L5 stated that lean was "already failing." It was determined L5's insights were not reflective of the entire population. For example, the working conditions word frequency analysis found the overall morale was improved,

communication was enhanced, and a “friendlier environment” was built through the lean implementation; whereas L5 felt there was no communication present in the company, and no support system was in place over the course of the implementation.

It was determined that L5 at CompB was a prime example of a disengaged employee. Randomly selecting to conduct the detailed analysis on L5 was beneficial to this study. Obtaining specific results from a disengaged employee allowed the researcher to easily compare and contrast that employee’s viewpoint with the rest of the L employees.

After the word frequency analysis it was clear that L employees at CompC would have benefited from a more structured training program. These employees relied on instruction from management in all aspects of lean implementation. This reliance resulted in missed opportunities for improvement and lower levels of engagement. When employees never take initiative to implement their own ideas their jobs become stagnant and disengagement sets in.

CompC lacked an adequate performance recognition program. Such a program would have raised involvement, increased performance results, and increased employee morale.

Results from cross-training were always positive. Specific accounts of cross-training led to improvements in efficiency, job satisfaction, work flow, downtime utilization, and ultimately engagement. Cross-training employees was a cheap and effective way to improve company performance on many fronts and should be further utilized.

All three organizations found communication to be very important. Disconnect in communication led to missed target dates, customer displeasure, and inefficient flow of

company processes. The implementation of lean was thought to improve communication, which translated to increased levels of work engagement.

Idea contribution systems proved to be an easy way for L employees to contribute ideas. Comment collection systems, however, received mixed results from employees at the companies in this study. This was not due to a lack of ideas contribution by L employees; it was due to lack of action taken by management. Setting up an effective system would allow for process improvement, increased job satisfaction, and heightened engagement.

5.2. FUTURE WORK

A lack of work engagement is not limited to employees in the United States – it is a worldwide problem. A study performed in 2005 found that overall, 24% of employee's worldwide were disengaged, 62% of employees were moderately engaged, and only 14% of employees were considered to be highly engaged (Smith, 2010). Other findings of this study showed a wide range between geographic regions in the percentage of their workforce who were highly engaged, with Mexico (40%) and Brazil (31%) being on the high end, the United States (21%) and Canada (17%) in the middle, and Europe (11%) and Asia (7%) at the low end (Attridge, 2009). The wide range in engagement level across countries suggests that examining cross-cultural differences in work engagement is an opportunity for further research.

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APPENDIX A: INTERVIEW GUIDE, EXECUTIVE (E) PERSONNEL

Position:

Company:

Interviewer:

Date:

Start time:

End time:

Introductory Comments

- Thank you for making the time for this interview.
 - The **purpose** of the interview is to **obtain your views on a number of questions related to lean manufacturing practices in your organization.**
 - Anything you say is confidential – nothing will be tied back to any individual names.
 - Provide participant with an estimate of the time to complete the interview.
1. When did your company first start focusing on becoming more efficient? When did actual implementation of more efficient practices first start?

 2. Did you begin the manufacturing improvement campaign company-wide or did you implement gradually by area? If the campaign was implemented gradually, can you give a schedule of implementation by area or department? What percent of your organization has participated in improvement efforts to date (by production line/cell)?

 3. What percent of your workforce has participated in these efforts? (Does everyone in an area become involved or is the focus more on people in supervisory roles?)

 4. Who leads the manufacturing improvement efforts in your company? (A dedicated department, HR, a member of management, etc.?)

 5. If a department has been created to lead these improvement efforts, what is the make-up of the team? (HR personnel, people from all areas of the company, IEs, MEs, etc.?)

6. How do the personnel leading these improvement efforts learn about efficient/lean practices? (Formal training, reading, etc.?)
7. How has the concept of implementing manufacturing improvement practices been introduced to the company? (Mandatory participation, voluntary, incentives, etc.?)
8. What are the resources available for implementing new practices? (Budget? Facilitation? Training?)
9. What have typically been the catalysts for change determining the need for new practices? (Customer-driven? Competition-driven? Etc.)
10. Does the company have particular goals it is working towards with the implementation of these practices? (Such as set-up reduction? Waste reduction?)
11. What types of performance measures are typically targeted when implementing a new idea or practice?
12. What is the typical format for rolling out a new practice and how long is spent in each portion of the roll out? (e.g., kick-off? Training? Analysis? Designing future state?)
13. How many people are typically involved in an implementation effort?
14. What is the composition of various teams involved in the implementation of a new practice? (Everyone, managers, line, clerical, etc.?)
15. What are some of the practices implemented so far in your company?

16. Have certain practices been more successful than others? Do you have a feel as to why some practices performed better than others? Examples?
17. Have certain practices not performed as expected? If yes, do you know why the practice didn't succeed in your area?
18. Have you discontinued any practices that were implemented for but were not mentioned above? If yes, why were the practices discontinued?
19. What types of objective/measurable benefits/results have you achieved with the practices implemented to date?
20. What types of non-measurable benefits have you realized as a result of implementing these practices?
21. To what extent are practices related to manufacturing improvement viewed as a success in your organization?
22. What are some of the positive or negative issues, previously not mentioned, that you have experienced in the implementation of new practices?
23. Do you have any practices scheduled for implementation? If yes, what do you hope to achieve with these practices?

APPENDIX B: INTERVIEW GUIDE, LINE (L) PERSONNEL

Position:

Company:

Interviewer:

Date:

Start time:

End time:

Introductory Comments

- Thank you for making the time for this interview.
 - The **purpose** of the interview is to **obtain your views on a number of questions related to lean manufacturing practices in your organization.**
 - Anything you say is confidential – nothing will be tied back to any individual names.
 - Provide participant with an estimate of the time to complete the interview.
1. When did your area first start focusing on manufacturing improvement? When did implementation of these practices first begin?
 2. Have you received any kind of training for these efforts or in implementing these practices? If yes, what kind of training did you receive?
 3. What is your understanding as to why it is necessary to be an efficient business? (customer-driven? Competition-driven? Etc.)
 4. Has your area had any particular goals in mind when implementing a new idea or practice? (Such as set-up reduction? Waste reduction?)
 5. What types of performance measures are typically targeted when implementing a new practice?
 6. What are the resources available for implementing new ideas or practices? (Budget? Facilitation? Training?)

7. When implementing a new idea or practice, does your area follow a formal schedule, and if so, how does it usually look? (e.g., kick-off? Training? Formal training, Training by other team members, Analysis? Designing future state?) How long do you spend on each portion of the schedule?
8. How many team members are actively involved in manufacturing improvements in your area?
9. What is the composition of your team when implementing a new idea or practice?
10. What are some of the things you have implemented or attempted to implement in your area?
11. Have certain ideas or practices related to improving your manufacturing operations been more successful than others? Do you have a feel as to why some performed better than others?
12. Have certain practices not performed as expected? If yes, do you know why the practice didn't succeed in your area?
13. Have you discontinued any practices implemented for the sake of manufacturing improvements that were not mentioned above? If yes, why were the practices discontinued?
14. What objective/measurable results did you actually **achieve** with the implementation of each practice?
15. What types of non-measurable benefits have you realized?
16. To what extent are these new practices viewed as a success in your area?

17. To what extent are these practices viewed as a success in your company?

18. What are some of the positive or negative issues not previously mentioned that you have experienced when implementing new ideas or practices?

19. Do you have any additional improvement practices scheduled for implementation? If yes, what does the team hope to achieve with these new practices?

