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Lean Manufacturing Culture: The Role of Human Perceptions of Standardized Work

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Abstract. Lean implementation and its sustainability are strongly coupled with organizational culture and consequently the culture defines success. Organizational culture is strongly linked with organizational dynamics. Work standardization is one of the lean tools whose role in terms of organizational performance improvement has been claimed in the literature; however, its implications in terms of employee's perceptions are still controversial. This study aims at investigating the effect of position on employee's perception about the standardized work. Four textile manufacturing companies in Pakistan were selected for the purpose of data collection, where the implementation level of the tool and organizational maturity towards lean adoption were initially measured. A questionnaire was administered to 326 employees from these organizations. The overall data sample was divided into two categories (white-collar and blue-collar). Data analysis was by F-tests (for identifying significance levels) and separate regression analyses (for identifying variables associated with negative perceptions of employees). A significant difference was found between white-collar employees, who were generally positive about the standardization of work, and the blue-collar employees that had negative perceptions. Moreover, the study concluded that positive perceptions about standardized work are directly linked with job satisfaction and inversely linked with job stress.

Keywords. Standardized Work, Employees' Perceptions, Sustainability, Lean Culture, Job satisfaction

1. Introduction

Modern working systems are facing many challenges where the most important aspect to be competitive in a globally integrated and highly unstable economy is to develop systems that can ensure the highest level of individual and organizational work performance. In particular, the textile sector needs to establish effective business practices to fulfil the demands of an industry which is one of the most vibrant and dynamic in the world. To address these challenges, the textile industry is working aggressively on lean production for gaining a competitive edge through a continuous

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improvement strategy and standardized work. As Liker and Meier stated “without standardization, continuous improvement could not be possible” [1]. The benefits of lean are controversial from an employee’s well-being point of view and so this study attempts to understand employees’ perceptions about ‘standardized work’ and the impact on ‘job satisfaction’ and ‘work-stress’ in the labour-intensive textile sector of Pakistan.

2. Literature Review

2.1. Lean Production Systems and Standardized Work Tools

Lean Production Systems (LPS) evolved after the second world war by the efforts of Taiichi Ohno, and is a business methodology which combines lean tools, principles and philosophy for value creation so that customer needs can be fulfilled. Organizations adopting this system are expected to gain competitive advantage through value addition, waste elimination and continuous improvement [2], [3]. LPS has been designed to eliminate seven types of wastes, to deliver good quality products in the right quantity and at the right time [4].

Standardized work is a basic lean tool developed by Taiichi Ohno in 1950 which provides the best standardized sequence of operations and times to perform the job on the production cell and also becomes the foundation for continuous improvement. Standardized work comprises of standardized 1) cycle times for the operations 2) operations sequences and 3) work-in-process inventories, which are required to maintain continuous production flow. The literature highlights benefits including; performance and throughput time improvement, consistent quality through reduction in variation and fatigue levels [1], [5]. Standardized work also helps in the training of team members that can further develop new standards and highlight opportunities for further improvements [6]. Standardized work also makes it possible to measure, compare and control employee behavior in a more formal way [7].

2.2. Employees Perceptions about Lean

The literature indicates the debatable impact of lean on employees; it could be positive or negative and sometimes both at the same time [8]. It has been concluded that standardized work reduces waste which is ultimately translated into increased intensity of work for operators [9]. In another study, it has been further concluded that work standardization is linked with negative effects like depression and low levels of job control [10]. It has been agreed that an increase in the intensity of work reduces work autonomy making the job of operators more stressful [11]. On other hand, it has been found that lean implementation results in improved employee health in the form of reductions in traumatic and chronic injuries along with stress control [12]. It can be concluded that the impacts of standardized work need further investigation so that a more realistic understanding about the challenges can be found and addressed accordingly [13]. There is very limited evidence concerning the impact of standardized work on employee’s perceptions [14] and hence this study is focused on further investigating the impact of standardized work on employees’ perceptions and how these perceptions are linked with job satisfaction and stress at work.

3. Research Methodology

3.1. Setting and Sample

To measure the employees' perceptions about standardized work, four textile organizations (number of employees > 4000) were selected for collecting survey data. Before actual data collection, the implementation level of lean (called the maturity level) was measured through well-defined tools available from the literature [15]. Data collection has been carried out through semi-structured interviews and survey-based questionnaires. For this study, the 'Work Standardization' tool was selected for further data collection and analysis. It was found that the implementation level of lean in participating organizations varies as shown in table 1. The maturity level of lean tools depends on the time after implementation as well as size of the organization [15]. Organization A has spent the most years on lean and is a larger organization as compared to the others, whereas organization D has spent the least time. Overall implementation levels were found to be good so it was possible to make a comparative analysis between the selected organizations.

Table 1. Lean level assessment in case organizations

Organization	Implementation level	Standard Deviation
Organization A	2.5 (High)	0.5
Organization B	2.1 (High)	0.5
Organization C	1.9 (Moderate)	0.6
Organization D	1.5 (Moderate)	0.6

3.2. Data Collection and Analysis

For the purpose of the final data collection, an instrument (5-point Likert scale) was designed ($\alpha=0.85$) and data was collected through a survey (N=326) of selected organizations. Among the 326 respondents, 29% belonged to the white-collar group and 71% were from the blue-collar group. To maintain the quality and confidentiality of information, the researcher personally administrated the survey. Mean values of data were used to measure the employees' perceptions of standardized work in their respective organizations. F-tests were used to measure the significance level of varying perceptions among the employees belonging to both categories and the variables associated with negative perceptions have been determined through regression analysis by using SPSS-20.

4. Results and Discussion

4.1. Employees Perceptions about Standardized Work

Table 2 shows overall employees' perceptions about standardized work on the basis of the data collected from four textile sector manufacturing organizations in Pakistan. An overall higher mean value against any question shows a positive perception about that particular variable. The top five items show a positive perception among the employees whereas the last five items show a negative perception about those specific items under consideration related to standardized work.

Table 2. Employees' perceptions about standardized work

Items	Descriptions	Mean	Std.dev.
1	Not difficult to develop standardized work sheet	3.18	1.188
2	Abnormality highlighted if not follow standardized work	3.04	1.473
3	Improve performance on the Job	3.02	1.374
4	Improve quality of the work	2.94	1.338
5	Makes Job easy to perform	2.92	1.393
6	Job comfortable ergonomically	2.57	1.451
7	Autonomy of work not decreased	2.28	1.335
8	Follow the same sequence of work not difficult	2.14	1.270
9	No stress felt to complete task within defined time limit	2.14	1.293
10	Opportunity to improve your work	2.02	1.288
11	Monotony of work does not make you fed-up	1.89	1.263
Overall		2.56	1.330

4.2. Collar-based Employees' Perceptions of Standardized Work

A comparative analysis between the perceptions of white-collar and blue-collar employees is shown in figure 1. It can be concluded that there is a significant difference in the perceptions of white-collar and blue-collar employees about work standardization. Overall white-collar employees' perceptions are highly positive (mean value 3.03) as compared to that of blue-collar employees (mean value 2.37).

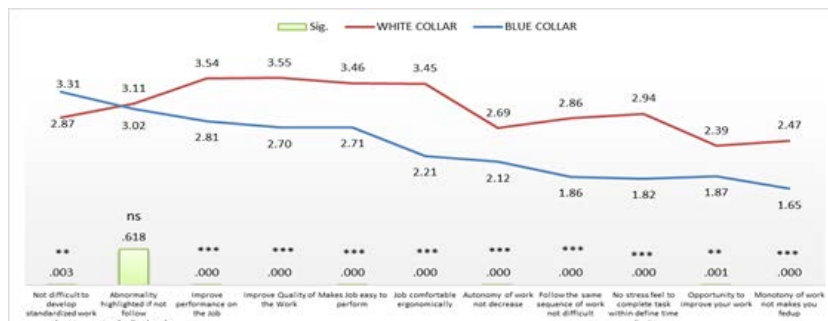


Figure 1. Collar-based employees' perceptions of standardized work

It can be concluded from figure 1 that for almost all aspects, white-collar employees have positive perceptions about standardized work except for item 1. This shows that white-collar employees usually feel that the development of standardized work sheets is a difficult thing to do as compared to blue-collar employees. Usually in most cases, white-collar employees are expected to develop standard documents. On the other hand, many other items which are mainly associated with actual job performance are perceived negatively by blue-collar employees. Both collar groups perceived that their autonomy at the work decreases; however, this perception is stronger amongst blue-collar employees.

4.3. Collar-based Employees' Perceptions: Relationship of Job Satisfaction and Stress

To understand the impact of perceptions on job satisfaction and stress, a comparative analysis is shown in figure 2. This indicates that white-collar employees are relatively more satisfied with their jobs (3.65) as compared to blue-collar employees (3.45). Job satisfaction levels of both groups is reasonably high showing that a vast majority is satisfied with the work and does not find it stressful. Conclusively, the perceptions of white-collar participants about standardized work were positive and they were highly satisfied with the job whereas, blue-collar perceptions were comparatively negative and they were less satisfied with the job. In this way, a direct relationship between positive perceptions and job satisfaction and the inverse relationship of positive perceptions with stress has been determined.



Figure 2. Perceptions and Job Relationship

4.4. Predicted Variables of Job Satisfaction and Job Stress

Regression analysis has been performed for white-collar and blue-collar respondents and the results are shown in table 3. It was found that ergonomics-based job comfort and ease in following the same sequence of operations are positive predictors of job satisfaction for white-collar employees. However, improving work performance was negatively linked with job satisfaction. This shows that because the responsibility for accomplishing the task in a timely way puts pressure on employees, white-collar employees also experienced stress and reduced job satisfaction. Whereas, blue-collar employees were satisfied with their job as they felt that standardized work improved their quality of work and performance at the job. However, blue-collar employees at the same time felt stress due to the pressure of completing a task within a defined time.

Table 3. Job satisfaction and stress predictors from standardized work

White collars	Blue collars
Job comfortable ergonomically ($\beta = .209^*$)	Improve quality of the work ($\beta = .149^*$)
Follow the same sequence of work not difficult ($\beta = .335^{**}$)	Improve performance on the Job ($\beta = .162^{**}$)
Improve performance on the Job ($\beta = -.317^{**}$)	No stress feel to complete task within define time ($\beta = -.149^*$)

* $p < .05$, ** $p < .01$, *** $p < .001$

β : Standardized coefficient

5. Conclusion

This study concludes that different employees perceive 'work standardization' in different ways. For example, it was found that the employees engaged in white-collar jobs in textile industries were relatively more positive about work standardization as compared to blue-collar employees. This is a very important concern for practitioners and management, as negative perceptions hinder organizational cultural change and also highlight key focus areas for improvement for successful lean implementation. The study also concluded that those with positive attitudes towards work standardization were more likely to be satisfied with their jobs and less stressful as compared to those with negative impressions. It was further revealed that pressure to complete a task within a defined time was a major source of job dissatisfaction and stress. However, there is a need to further investigate this complex phenomenon where multiple factors can affect different employees in different ways. Organizations need to learn about negative perceptions, possible causes and how to address the issues while implementing lean practices. This study was conducted in Pakistan and only one sector was covered so the conclusions cannot be generalized. Further investigations in other manufacturing sectors can help in understanding the phenomenon of negativity and then more comprehensive and holistic strategies can be adopted to address the issue.

References

- [1] J.K. Liker and D. Meier, *The Toyota Way Field book: A Practical Guide for Implementing Toyota's 4Ps*, New York: McGraw-Hill, 2006.
- [2] J.P. Womack, D.T. Jones and D. Roose, *The Machine that changed the world*, Simon and Schuster, 1990.
- [3] E. Lodgaard, J.A. Ingvaldsen, S. Aschehoug and I. Gamme, Barriers to continuous improvement: perceptions of top managers, middle managers and workers, *Procedia CIRP* **41** (2016), 1119-1124.
- [4] J.K. Liker, *The Toyota Way: 14 Management Principles from the World's Greatest Manufacturer*, McGraw-Hill Education, 2004.
- [5] J.S. Toussaint and L.L. Berry, The promise of Lean in health care, *Mayo Clinic Proceedings* **88** (2013), 74-82.
- [6] M. Ml̄kva, V. Prajova, B. Yakimovich, A. Korshunov and I.Tyurin, Standardization - one of the tools of continuous improvement, *Procedia Engineering* **149** (2016), 329-332.
- [7] A. Naduzzo, E. Rocco and M. Warglien, Talking about routines in the field: The emergence of organizational capabilities in a new cellular phone network, *The Nature and Dynamics of Organizational Capabilities*, (2001), 27.
- [8] P. Arezes, D. Carvalho and A.C. Alves, Threats and opportunities for workplace ergonomics in lean environments, In *17th International Annual EurOMA Conference-Managing Operations in Service Economics*, 2010.
- [9] J. Eklund and P. Berglund, Reactions from employees on the implementation of Lean production, *Proceedings of the 39th Nordic Ergonomics Society (NES) Conference*, 2007.
- [10] S.K. Parker, Longitudinal effects of lean production on employee outcomes and the mediating role of work characteristics, *Journal of Applied Psychology* **88** (2003), 620-634.
- [11] T.A. Saurin and C.F. Ferreira, The impacts of lean production on working conditions: A case study of a harvester assembly line in Brazil, *International Journal of Industrial Ergonomics* **39** (2009), 403-412.
- [12] S.L. Hunter, The Toyota Production System applied to the upholstery furniture manufacturing industry. *Materials and Manufacturing Processes* **23**(7) (2008), 629-634.
- [13] P.E.C. Johansson, T. Lezama, L. Malmskold, B. Sjogren and L.M. Ahlstrom, Current state of Standardized Work in automotive industry in Sweden, *Procedia CIRP* **7** (2013), 151-156.
- [14] S. Braganca and E.M. Costa, An application of the lean production tool standard work, *Jurnal Teknologi*, **76**(1) 2015, 47-53.
- [15] R. Shah and P.T. Ward, Lean manufacturing: context, practice bundles, and performance, *Journal of Operations Management* **21** (2003), 129-149.