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Analysis of Six Sigma for Continuous Improvement through Visual Process Control: Case Study

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ABSTRACT

The present research is motivated by the changing roles of continuous improvement programs as a result of changes in organizational environments. Focus on the changing demands made on organizational infrastructure for continuous improvement program is under consideration. Visual process control is applied in a financial section of a company. The success of Six Sigma programs depends to a large extent on motivating employees, training them and coordinating their efforts in projects as well as implementing changes resulting from projects. Managers are interviewed (Total 12) and on the basis of score the improvement are analyzed.

Introduction

Six Sigma

It has been extensively documented by the previous literature, Lean (Ohno, 1988) is an improvement approach primarily focused on reducing waste and improving efficiency. According to Jing (2009) Six Sigma is an improvement methodology that is primarily aimed at improving process capability by reducing variation, variation is reduced by being consistent. Magnusson et al (2003) define Six Sigma as a business process that allows them to monitor everyday business activities and design ways that minimize waste and number of resources which will improve their profitability, and all while increasing customer satisfaction. Antony (2006) discussing Six Sigma with reference to service processes is of the opinion that the term sigma is a measure indicating the deviation in the performance characteristic of a service from its mean performance. Therefore, the basic goal of a Six Sigma strategy is to reduce variation within the tolerance or specification limits of a service performance characteristic.

The Six Sigma program has gained tremendous popularity as a continuous improvement (CI) program in all types of organizations – manufacturing, service and non-profit organizations. Six Sigma is defined as "A comprehensive and flexible system for achieving, sustaining and maximizing business success. Uniquely driven; by a close understanding of customer needs, disciplined use of facts, data and statistical analysis, and diligent attention to managing, improving and reinventing business processes". Six Sigma has process-variance reduction as its predominant focus with project goals tied to overall organizational strategic goals (Linderman et al., 2003). Six Sigma projects are implemented by teams that include frontline employees using a scientific method to discover process improvements. Six Sigma projects often involve analysis of external environmental factors and internal contextual conditions to ensure alignment with both (de Mast, 2006).

Thus Six Sigma is geared to fulfill the three CI program roles of dynamic strategic initiative, learning and alignment with the business.

Continuous Improvement

The insistence of pre specified goals for every project forces the team to assess the numerical value of the project in units such as defect rates or time. This ensures that every change that emerges as a result of the project is grounded in real data. The magnitude and type of goals also have psychological implications on team members (Linderman et al., 2003); on the one hand impossible goals can dishearten employees and on the other, stretch goals can motivate them to extend performance frontiers. Improvements from Six Sigma projects have to be approved by independent financial controllers and this provides a check against crediting project teams with illusionary and unreasonable credits for improvements. It also points to areas in which improvements are difficult. In order to guard against situations where short term benefits may be easy to achieve while long term benefits may be hard to sustain, some organizations give credit to project teams for improvements only after a suitable extended period.

Visual Control

According to Liker (1997) visual controls can provide employees and managers with simple but effective ways of understanding current working conditions, which allow for corrective actions to be taken. Womack and Jones (2003) also support this thinking, while referring to it as transparency, specifically to highlight the need for everyone to view all the activities that occur along a value stream which flows throughout departments and organisations. Hirano (1994) also states that visual control highlights if a situation is adding

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value or waste. George (2003) is also supportive, but refers to it as visual management.

Perhaps the simplest way to understand the importance of visual controls is the analogy provided by Mann (2005, p.37) – "if *takt* time is the heart of lean production, visual controls and the process surrounding them represent the nervous system". Visual process controls involve using various displays, such as posters and charts, or visual markers, such as flags and floor markings, which are conspicuously displayed for work team or department so that everyone is aligned. Visual process controls have many beneficial qualities as they establish and communicate what the work priorities are; display what the target is and if the targets have been met; the process is displayed which shows all dependent relationships and any process bottleneck processes and milestones; the process issues can be flagged, and quickly addressed with an understanding of the knock-on effect; show details of the standardized work methods; feedback to and from management can be detailed and it eliminates the need for meetings (George et al, 2005).

Research Methodology

Toward this purpose we collect information on visual control using semi-structured interviews with Six Sigma executives of manager level. The method of data collection that has been chosen by the author for this study is qualitative. The justification for this is that the research which was undertaken was focused on understanding the impact of implementing one of the Lean Six Sigma process improvement tools, visual process controls, on an accounting department's month-end activities, and also to understand if it is an effective improvement tool in an accounting department environment.

The research is required to be qualitative as it needs to take into account the experiences and views of the production manager, maintenance expert, quality engineer and management within the production departments on using visual process controls as a process improvement tool. Qualitative research was chosen over quantitative as it is a better method in making sense of statements and opinions that are collected from the interviewees. Silverman (2006) makes the point that qualitative researches' main strength is its ability to study phenomena which are not available elsewhere, particularly areas of social reality which statistics cannot measure.

Semi-Structured Interviews

As part of the preparation for this study the author has carried out a broad literature review in the area of Lean, Lean Thinking and Lean Six Sigma process improvement methodology and techniques, and a detailed literature review specifically on visual process controls. The review included both academic and practitioner articles.

The author being familiar with both organizations and departments, and the additional information gained from the literature review, prepared the questions for the interviews that were appropriate and relevant to the study. One to one semi-structured interviews was the primary data gathering method for this study, therefore the researcher needed to get the answers to the two research objectives solely based on the responses in these interviews. The researcher had the opportunity to interview twelve of the case company and production departments' twenty individuals. They were appropriately spread between the various sub-functions of the production department to give a fair reflection of the impact and effective use of the month-end visual process control board. There are total 12 managers are interviewed and data is being collected for the further analysis.

Analysis of Data

As the author has previously detailed the data collection method has been qualitative, however, the data analysis methods used will be both qualitative and quantitative. The quantitative analysis will be used to rate how effective or not the respondents perceive the use of the visual process control board to be. For the purpose of this study, the term 'effective' has been given the operational definition: Visual Process Controls will be deemed to be *an effective process improvement tool for production department environment* if after the summation calculation using the scoring. Scoring used to Calculate Effective Rating, based on the respondent answers from questions in the interview equals or is above a score of sixty.

Research Findings

Interviewee background will identify the organization which is based in and the role they fulfill within that organization. The author will also detail if the participant was aware of the implementation of the Lean Six Sigma tool – Visual Process Control board for month-end activities within the department, and the author will detail if the candidate has used this tool before.

Further to identify the findings in response to questions relating to the impacts that the interviewees had perceived as a result of the introduction of the month-end Visual Process Control board on:

- The month-end process
- The Production leadership team
- The operations in Production and shared services.
- Team behaviors
- Tools, systems or processes
- Team communication (Horizontal and/or Vertical)

In response to rating the overall experience of the introduction of visual process controls in their Production environment the respondent stated that it was good because it was possible now to understand the end to end process and each task's interconnectivity dependencies.

Table 1. Calculation of Scoring for Effective Rating for Respondent A.

Question	Score	Adjustment	Total
11	15	NA	15
12	20	0	20
13	20	0	20
14	15	0	15
16	15	NA	15
Total		85	

The calculation of the score for respondent A (as illustrated by Table 1) which is used to deem the month-end visual process control board as an effective process improvement tool for a Production department environment is 85. Therefore, based on the criteria outlined in the Research Methodology chapter, the visual process controls that are in use in the Production departments are an effective process improvement tool for a Production environment.

Effectiveness and Clarity of the Month-End Visual Process Control Board

When asked how effective the month-end visual process control board was the respondent deemed the use of the month-end visual process control board to be effective. However, the respondent articulated that there is still room for improvement as the process lacks an owner at the Production leadership level and that steps on the visual process control board are deemed of equal importance.

In response to rating the overall experience of the introduction of visual process controls in their Production environment the respondent thought it was good saying that there was potential for benefits to be gained. However, the concerns raised by team members at the status check meetings needed to be addressed.

Table 2. Calculation of Scoring for Effective Rating for Respondent C.

Question	Score	Adjustment	Total
11	15	NA	15
12	20	0	20
13	15	0	15
14	-15	0	0
16	15	NA	15
Total		65	

The calculation of the score for respondent C (as illustrated by Table 2) which is used to deem the month-end visual process control board as an effective process improvement tool for a Production department environment is 65. Therefore, based on the criteria outlined in the Research Methodology chapter, the visual process controls that are in use in the selected Production departments are an effective process improvement tool for a Production department environment.

Summary of Visual Process Controls Findings

Participant E was based at the selected facility and is a member of the Production Leadership team. The respondent had no previous knowledge of Lean Six Sigma or its use within other organizations. The respondent was fully aware of the implementation of Visual Process Control board for month-end Production activities.

In response to rating the overall experience of the introduction of visual process controls in their Production environment the respondent thought it was good there being clear understanding of the dependencies, better and improved readiness for the cost reviews, and improved efficiency of the close cycle time by moving tasks earlier had been instrumental in its success.

Table 3. Calculation of Scoring for Effective Rating for Respondent E.

Question	Score	Adjustment	Total
11	15	NA	15
12	20	0	20
13	20	0	20
14	15	0	15
16	15	NA	15
Total		85	

The calculation of the score for respondent E (as illustrated by Table 3) which is used to deem the month-end visual process control board as an effective process improvement tool for a Production department environment is 85. Therefore, based on the criteria outlined in the Research Methodology chapter, the visual process controls that are in use in the Production departments are an effective process improvement tool for a Production department environment.

In response to rating the overall experience of the introduction of visual process controls in their Production environment the respondent stated it was neutral. “The visual process control board is good, but poor in the fact it hasn't driven home improvements because senior management don't take too much notice of it or they feel it is a substitute for them”.

The calculation of the score for respondent K (as illustrated by Table 4) which is used to deem the month-end visual process control board as an effective process improvement tool for a Production department environment is 30. Therefore, based on the criteria outlined in the Research Methodology chapter, the visual process controls that are in use in Production departments are not an effective process improvement tool for a Production department environment.

Table 4. Calculation of Scoring for Effective Rating for Respondent K.

Question	Score	Adjustment	Total
11	15	NA	15
12	20	-20	0
13	20	-20	0
14	15	0	15
16	0	NA	0
Total		30	

Summary of Results

The data from twelve respondents has been used in this study. The findings on the use of Visual Process Controls within a Production department environment being an effective process improvement tool have been summarized in Table 5. They show that two of the twelve respondents or 17% deem their use to be not an effective tool in this environment, while ten or 83% have deemed their use to be effective.

Table 5. Effective Rating for the use of Visual Process Controls.

Respondents	Effective Rating Score	Deemed Effective
A	85	Yes
B	45	No
C	65	Yes
D	75	Yes
E	85	Yes
F	95	Yes
G	85	Yes
H	85	Yes
I	85	yes
J	90	yes
K	30	No
L	90	yes
Average	76.3	Yes

Visual Process Controls being deemed effective in a Production environment, in this dissertation, supports Liker (1997) who stated that visual controls provide employees and managers with simple but effective ways of understanding current working conditions, which allow for corrective actions to be taken.

The average effective score based on the 12 respondents is 76.3. Taking a holistic view of the data for this study the researcher deems the use of Visual Process Controls within a Production department environment to be an effective process improvement tool. These findings support Dinero (2005) who stated that Lean Thinking has changed the focus of improvement processes from manufacturing areas to the whole organization – i.e. a Production department.

Conclusions

Within the primary research, the author was conscious of the need to extract some lessons from the experience of the respondents on their use of the month-end visual process control board within a Production environment. There is clear evidence, from the qualitative analysis of the respondents’ interview data and quantitative scoring to deem if the tool’s use within a Production environment is effective or not, that there are beneficial impacts from its introduction and the tool is deemed effective for use within a Production department environment.

However, as outlined above, the documented issues and deficiencies those have been highlighted by the respondents

are the failings of not having an effective all encompassing framework to support the tool.

The author recommends that this core issue relating to having an all encompassing framework be addressed by the Production leadership team. The other issues and deficiencies should be worked on in project teams within both sites to seek remedies as they are merely serving as barriers to even greater process improvements and savings for selected manufacturing industries.

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