SHORT COMMUNICATION

AN INVESTIGATIVE STUDY OF SIX SIGMA AS A POSSIBLE SOLUTION TO SUPPLY CHAIN INEFFICIENCIES IN THE SEZELA MILL AREA

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Abstract

The supply chain, from the grower to the mill, is currently experiencing costly and inconvenient bottlenecks which can stop the whole supply chain from functioning. The industry allows each party to be responsible for its own quality and process management. Many researchers have called for the consolidation of the fragmented supply chain into a more cohesive unit. Six Sigma, a supply chain management system that originates from the electronics industry, is renowned for stimulating integrated systems thinking and improvements. Six Sigma is defined as the 'relentless and rigorous pursuit of the reduction of variation in all critical processes to achieve continuous and breakthrough improvements that impact the bottom line of the organisation and increase customer satisfaction'. However, in the sugar industry Six Sigma faces some challenges, including a high risk environment as a result of the weather, and the high level of segmentation in the supply chain. This study aimed at testing whether or not it would be feasible to adopt a Six Sigma management approach in the South African sugar industry as a means of improving the value chain. Research was carried out at Sezela with a survey that involved explanatory and exploratory aspects of the system. Questions that were asked focused on issues of supply chain efficiency, problem areas, possible solutions, management capabilities, integration strategies, performance measures, stakeholder relationships, costs, information sharing, process control and centralised management. The research showed that, although perhaps viable in the future, it would not currently be feasible to adopt a Six Sigma management approach in the Sezela milling area. There may also be better alternatives to use to pursue continuous improvement within the sugarcane supply chain. The '5 Whys' exploratory tool may be a strong candidate because of its flexibility and strength.

Keywords: sugarcane, supply chain, six sigma, management, Sezela

Introduction

While the South African sugar industry is under pressure to process all cane over the period March to December, management in the industry is segmented with multiple stakeholders who do not always work cohesively. Wynne (2005) confirms that this is 'intrinsically difficult to optimise due to the involvement of large numbers of independent stakeholders'. As a result, the supply chain, from the grower to the mill, is currently experiencing costly and inconvenient bottlenecks which can stop the whole supply chain from functioning. Many

authors, such as Wynne (2005), Le Gal and Requis (2002), and Higgins *et al.* (2005), have called for the consolidation of the fragmented supply chain into a more cohesive unit.

The local industry allows each party to be responsible for its own quality and process management. Although measures are in place to incentivise this management, no central control exists. The new payment system has made returns directly proportional to quality levels, to encourage growers to improve the sucrose levels through the growing process and also to minimise the harvest-to-crush delay (DTI, 2000; Wynne, 2001). The miller has also implemented penalty systems. The growers and hauliers are left to self-manage, but the penalties encourage them to manage well. However, Wynne (2001) argues that 'the continued threat of penalties is necessary to maintain the incentive to deliver effectively'. The fragmented nature of the system often promotes selfishness and trust levels are often low. Higgins *et al.* (2005) found a widespread lack of trust under similar conditions in Australia, especially in the form of negative perceptions from the upstream participants towards the miller.

Six Sigma originated at the Motorola Corporation in the late 1980s, at which time the firm was having trouble with defects which were increasing costs. Motorola subsequently implemented an organisation-wide quality management system (Raisinghani *et al*., 2005). The change in techniques earned Motorola the prestigious Malcolm Baldrige National Quality award (Heizer and Render, 2006). Six Sigma is defined as the 'relentless and rigorous pursuit of the reduction of variation in all critical processes to achieve continuous and breakthrough improvements that impact the bottom line of the organisation and increase customer satisfaction' (Gitlow *et al.*, 2005). Statistically, the aim of Six Sigma within a manufacturing organisation is to reduce process variation to a level of accuracy of 99.9997% (Davis and Heineke, 2005). The formal Six Sigma improvement model comprises five processes: Define, Measure, Analyse, Improve and Control (DMAIC). These processes are normally instituted by an overarching leadership regime.

In the sugar industry Six Sigma faces some challenges, including a high risk environment as a result of the weather, and the high level of segmentation in the supply chain. Six Sigma is more easily achieved in a single company, such as Motorola, than across multiple groups where trust and information sharing may be a concern. Some firms were of the opinion that, as a practice, Six Sigma does not deserve all the praise it receives (Raisinghani *et al*., 2005). This is because, where it is not incorporated in full, Six Sigma is unlikely to be successful.

Although several researchers have focused on the integrated sugarcane supply and processing chain (e.g. Higgins *et al.*, 2005; Le Gal *et al*., 2008a, Le Gal *et al*., 2008b), no literature could be found where the Six Sigma principles have been evaluated for sugar production. This study aimed at testing whether or not it is feasible to adopt a Six Sigma management approach in the South African sugar industry as a means of improving the value chain. The supply chain extends from the grower, through the harvesting and transport sectors, to the mill, and ends inside the mill where the product is transformed into raw or refined sugar. Because of cane deterioration, this part of the sugar supply chain's logistics is not driven by market factors, but rather by the biophysical factors controlling the quality of the product.

Methods

Research was centred around the sugarcane supply chain of the Illovo sugar mill at Sezela on the KwaZulu-Natal south coast. Individual stakeholders at Sezela have already made

significant attempts to consolidate the supply chain into a more integrated system. They are also using tools, such as cross-functional teams, to drive collaboration between stakeholders and to increase efficiency. Data were gathered in a qualitative nature and constitute both explanatory and exploratory aspects of the system. Data capture was conducted during semi-structured interviews with key role players in the supply chain. The scope of the study prohibited a wide-scale data collection effort. Certain stakeholders from the mill, hauliers and growing fraternity were interviewed. All interviewees were involved in the day-to-day operations of one or more parts of the supply chain. Questions that were asked focused on issues of supply chain efficiency, problem areas, possible solutions, management capabilities, integration strategies, performance measures, stakeholder relationships, costs, information sharing, process control and centralised management. Appendix A provides the interview guide that was followed and the Results and Discussion section below briefly summarises the main findings. More detailed results are available in Aling (2008).

The data were subsequently synthesised and were drawn into the Six Sigma management context. It should be noted that, while not all role players in the Sezela supply chain were interviewed, the key stakeholders who were interviewed form critical links in the supply chain. Therefore, although the data may be biased, a negative signal from these key persons would imply that Six Sigma is likely to fail. However, a positive signal would not necessarily imply possible success, but rather room for further research.

Results and Discussion

The research showed that it would not currently be feasible to implement a Six Sigma type management style in the Sezela mill area. However, it must be noted that the stakeholders are already taking steps to integrate the supply chain, since they have recognised this as a major cause of inefficiencies. The different sectors are working together via the use of cross-functional teams and the implementation of new scheduling practices. This shows that the stakeholders are willing and that Six Sigma could be adopted in the future.

A major concern was whether or not the activities could be monitored and measured accurately enough to implement an effective Six Sigma programme. The research shows that as more technology is used in the supply chain it becomes easier to monitor and manage activities. This is further reinforcement that the Six Sigma system could be implemented at a later stage.

However, from the interviews it became clear that a Six Sigma programme may not be the best way to address the challenges, and that there may be better alternatives to use in pursuing continuous improvement within the supply chain. In the Sezela area there is no management body within the supply chain which has enough authority to enforce the rules of Six Sigma. The supply chain is highly segmented and some stakeholders are unwilling to change current practices. Stakeholders are also highly independent. Although the mill is the central body of the supply chain, managers at the mill do not have enough power to control the management styles of participants to a large enough extent for the system to be effective. Therefore, stakeholders should consider implementing other forms of continuous improvement programmes. For example, Toyota, one of the world leaders in lean production, does not use Six Sigma, as it views the programme as one which focuses solely on reducing variation and saving money. Toyota management is of the opinion that Six Sigma turns different parties within an organisation against each other and is not the ideal system (Liker and Meier, 2005).

Instead of Six Sigma and other complex statistical tools, Toyota uses the '5 Whys' (Liker, 2004). As such, the company tries to keep things as simple as possible. The managers at the company analyse weak points in the system by asking 'Why?' five times. This method is simple and yet goes deep enough to change the culture of the business if that is where the problem lies.

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APPENDIX A: INTERVIEW GUIDE

Preamble: Introductions and thanks for agreeing to participate in the research process. Give a short introduction of the study and focus specifically on Six Sigma, as few people are likely to know what it is. Once the interviewee has been briefed on the study and Six Sigma the interviewer will use the following questions as a structure for the interview:

Supply chain:

1. What is your general feeling about the operations and efficiency of the supply chain as a whole?
2. What are the major problems within the chain at present and what are the major causes of these?
3. In which sectors do these problems originate?
4. Are there any remedies that you could suggest?
5. What are the current management structures within the supply chain? Do you feel that they are effective or could they be improved?
6. Are there currently any integration strategies being used? How effective or ineffective are they? Reasons?
7. Is your specific sector of the chain running and managing efficiently?
8. What are the performance metrics that you use to gauge the efficiency of your operations? (How do you measure quality?) E.g. RV, lead times, viscosity of syrup.
9. Can these be measured accurately enough to be plotted graphically and used in statistical process control?

Six Sigma:

1. What are interrelations currently like within the supply chain? How co-operative are the different sectors? Are these relationships a problem or strength for the chain?
2. Would you be willing to take steps to integrate the chain? This may include falling under a central management umbrella where you lose some control of your processes. E.g. scheduling of vehicles or harvest.
3. Would you be willing to give up control over the management of an asset you owned? E.g. handing over the scheduling and running of a truck to the central management.
4. If a system such as this were implemented the running costs would be incurred. Would you be willing to pay some of the costs? How would you feel about incurring a portion of these costs?
5. **Would the mill be willing to administer the program? Whoever ran the system would need to have a cross-functional team on hand to address problems that arose. This may mean hiring new employees or moving current employees onto that project.
6. **Would you be happy for the mill to administer the program? This may mean relinquishing some control to them. If not who would you suggest to run the program?
7. Would you be willing to share sensitive information with the other stakeholders? This may be financial info or trade related information. How far would you be willing to take this info sharing?
8. Would you be willing to commit to a holistic program such as this?
9. Would you be willing to take short term inconveniences and losses for the overall benefit of the system? This may be necessary before benefits can be received. (Have advantages and disadvantages ready!!)

Concluding the interview: At the end of the interview the researcher will thank participants for their time and effort. Any queries must be answered before concluding the interview.