Lean Strategy Failure: Steel Industry Example

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ABSTRACT: The effectiveness of a company’s strategy is critical to its success or failure, and strongly depends on daily operations and decisions. Among production and manufacturing supply chains, Lean strategy is widely recognised as important to business success and competitive advantage. However, process industries lag behind discrete industries in the uptake of Lean strategy. This paper reports a case of an implementation of Lean strategy in a steel-manufacturing organisation, which, despite initial benefits, was not sustained. The study identifies assumptions that influence a successful implementation of Lean strategy. These assumptions are concerned with the source of business success, the way to address customer demand, the role of kanbans, the way to achieve high utilisation, and the length of lead times.

Keywords: Lean strategy, Steel industry, Contextual decision making, Case study

INTRODUCTION

The effectiveness of a company’s strategy is critical to its ultimate success or failure (Thompson, Strickland & Gamble, 2008). Aligning daily operations with the strategy can determine whether it is successfully and effectively enacted (Voss, Åhlström & Blackmon, 1997). Therefore, business success relies not just on the selection of a strategy but also on its execution to ensure customer satisfaction and optimal performance. Strategy execution and sustainability often depends critically staff involved in daily decisions and operations (Bird & Beechler, 1995; Harris & Ogbonna, 2001).

Among businesses which employ production and manufacturing supply chains, Lean strategy is widely recognised as important to business success and competitive advantage (Pfeffer, 1994; MacDuffie, 1995; Lewis, 2000; Shah & Ward, 2003). Even critics admit that Lean strategy sets the standards for production and manufacturing strategies in the 21st century (Shah & Ward, 2007). It has been shown to outperform the traditional production model of large batches and high inventories (Boyer et al. 1997; Nakamura et al. 1998), and has successfully enabled businesses around the world to address customer demand, while maintaining high production volume (Ohno, 1988; Sohal & Egglestone, 1994; Sriparavastu & Gupta, 1997; White, Pearson & Wilson, 1999). Paradoxically, Lean strategy enables these improvements while permitting (or in fact, requiring) lower inventory, contrary to traditional practices. However, not all industries have taken up this strategy to the same degree (Dennis & Meredith, 2000).
Discrete industries, the original setting in which Lean strategy was developed (Holweg, 2007), have been more successful than process industries at reducing waste and inventory levels (Schonberger, 1982; Dennis & Meredith, 2000; Abdullah & Rajgopal, 2003). In contrast, process industries lag behind discrete industries in the uptake of Lean strategy (Dennis & Meredith, 2000; Abdullah & Rajgopal, 2003; Belvedere & Grando, 2005). These industries often continue to operate according to a “Push” strategy, where each production unit strives to maximize its output in isolation of the rest of the supply chain. This paper aims to investigate the reasons behind this lag in adoption of Lean strategy.

The difference in uptake between the two industry sectors suggests that process industries are innately unsuitable for the successful adoption of Lean strategy, but this is not the case. The steel industry is characterised by high volume and relatively predictable demand, two traits that can make it a good candidate for the benefits of Lean strategy (Christopher, 2000; Christopher & Towill, 2002). Indeed, several reports of successful adoptions and executions of Lean strategy in the steel industry exist, (Dhandapani, Potter & Naim, 2004; Harrison, 2005; Abdulmalek & Rajgopal, 2007; Storck & Lindberg, 2007), suggesting that the steel industry can adopt at least some of its aspects. These reports, however, do not explain why Lean strategy is not accepted more widely in process industries, such as the steel-making, chemical, paper, and oil industries.

Examining a case where Lean strategy was rejected in a process industry can shed light on the factors that may impede its wider adoption amongst similar industries. Failed projects are a potential source of valuable lessons that can provide insight for future change attempts (Cannon & Edmondson, 2005; Sauer, 2006; Bartis & Mitev, 2008). An examination of failed change projects reveals obstacles and hindrances that could not have been predicted (Williams, Ackermann, Eden et al., 2005). The obstacles often stem from organisational complexities and
contextual interrelationships, and are thus contingent on variables specific to the organisational
and industrial context.

This paper reports a case of an implementation of Lean strategy in a steel-manufacturing
organisation, which, despite initial benefits, was not sustained. Studying the eventual rejection
of Lean strategy in this organisation provides a unique opportunity to identify assumptions that
can be responsible for the low uptake of Lean strategy in process industries.

**Key Principles and Assumptions of Lean Strategy**

Lean strategy is driven by three main principles that affect daily production operations:

1. **Value**
2. **Paced production**
3. **Continuous improvement**

A brief definition of each principle and its impact on daily operational decisions is presented next.

**Value**

Lean strategy takes a customer-centric view of value creation, and determines the value of the
final product based on what the customer is willing to pay for it (Ohno, 1988). This is in contrast
to traditional production and operational strategy, which takes a cost-centric view and determines
product value and price based on production costs (Aitken, Childerhouse, Christopher et al.,
2005). These different perspectives also mean different priorities. Traditional strategy
prioritises economies of scale to reduce costs-per-unit, and thus prefers large batches. Lean
strategy, in contrast, does not assume success resides in scale economies. Rather, it emphasises
quick delivery, which is seen as an important source of value; Lean strategy prioritises small
batches that reduce overall production lead time (Womack & Jones, 2003).

**Paced production**

Lean strategy aims to optimise production over the entire business (Ohno, 1988; Rother
& Shook, 2003; Womack & Jones, 2003). This is in contrast to traditional production strategy,
where each production unit seeks to optimise its own operations (Schonberger, 2007; Taylor &
Taylor, 2008). The difference in the scope for optimisation leads to a different view of product
flow. Lean strategy aims for a continuous flow of product (Huang & Kusiak, 1996; Sewell &
Wilkinson, 2001). To achieve this continuous flow, Lean strategy requires that production is controlled and paced along the entire supply chain, by scheduling small and standardised batches (Rother & Shook, 2003; Hopp & Spearman, 2004). This preference for small batches and paced production is contrary to the traditional focus on local optimisation of the performance of each unit, which inevitably leads to production in large batches (Simchi-Levi, Kaminsky & Simchi-Levi, 2003).

To control and pace production, Lean strategy typically uses a mechanism called “kanban” (Ohno, 1988). Kanbans facilitate “Pull” production, and prevent production according to the traditional “Push” strategy, by indicating the level of intermediate product between two production units (Huang & Kusiak, 1996). When these levels reach a permitted maximum, the kanban is considered “full” and indicates that the supplying unit should stop production. Adherence to kanbans is central to the enactment of Lean strategy (Hopp & Spearman, 2004), whereas in the traditional strategy, kanbans can be an impediment to the localised performance of individual units.

Continuous improvement

Lean strategy places a strong emphasis on striving for perfection, and views production operations as an inseparable part of this pursuit (Ohno, 1988). Lean strategy requires that processes are constantly re-examined in search of imperfections, and relies on low inventory levels to expose these imperfections (Womack & Jones, 2003). This is as opposed to the traditional strategy, which episodically addresses problems and improvements, but does not necessarily seek a fundamental solution. The traditional strategy is happy to rely on inventory levels to buffer potential problems.

Lean strategy identifies imperfections through evidence of excess raw material, overproduction (i.e., producing more than ordered), unnecessary transportation, lengthy setups, overselling (i.e., selling more than can be produced), defects, unwarranted labour, complex
solutions, unproductive use of energy, ineffective space and layout, or unnecessary motion (Ohno, 1988; Monden, 1994; Womack & Jones, 2003; Taylor & Taylor, 2008). To expose such sources of imperfection, Lean strategy relies on low levels of intermediate product inventory, also termed “work-in-process” (WIP). This is in contrast to the traditional strategy, which often results in high levels of WIP. Table 1 summarises the differences between principles of Lean and traditional strategy, along with their practical implications.

[INSERT TABLE 1 HERE]

The requirement to strictly maintain low WIP levels throughout the supply chain of a business is central to sustaining Lean strategy (Hopp & Spearman, 2004). Reduced supports the achievement of Lean principles: low WIP levels enforce paced production, expose imperfections for improvement, and force value generation in ways that do not rely on scale economies.

WIP levels, like other inventory levels, are not controlled directly (Sterman, 1989), but result from indirect daily operational decisions regarding batch sizes, number of changeovers, and aspired inventory levels. These decisions are routinely addressed by schedulers (MacCarthy & Wilson, 2001), often operating in teams that include planners and controllers (McKay & Wiers, 2003). Consequently, the role and impact of schedulers on the enactment of Lean strategy warrants discussion.

SCHEDULERS – STRATEGY EXECUTORS AND DECISION MAKERS

Schedulers are responsible for bridging and synchronising production capabilities and customer demand (McKay & Wiers, 1999; Jackson, Wilson & MacCarthy, 2004). They regularly balance and trade-off conflicting requirements of timely delivery and capacity utilisation (Cegarra, 2008). When schedulers prioritise these requirements in alignment with Lean strategy, the strategy is successfully executed (van der Krogt, Geraghty, Salman et al., 2010). Therefore, the enactment of Lean strategy depends on the way schedulers prioritise and trade-off conflicting requirements (Baker & Scudder, 1990).
Since schedulers’ daily decisions on priorities affect the sustainability of Lean strategy, it is important to understand what factors might influence their decision-making. Previous studies of schedulers have identified that they often rely on behavioural decision-making strategies (MacCarthy & Wilson, 2001; Cegarra, 2008), which are typically sensitive to a myriad of factors (Hogarth, 1987; Payne, Bettman & Johnson, 1993; Mellers, Schwartz & Cooke, 1998; Kahneman, 2003). The behavioural decision-making literature describes three categories of factors that influence human decisions: individual, task, and context (Payne et al., 1993; Mantel, Tatikonda & Liao, 2006). The “individual” category includes characteristics relating to the person making the decision, was examined elsewhere (Alony, Caputi, Coltman et al., 2009). This paper focuses on basic assumptions that influence factors from the two other categories, “task” and “context”. These assumptions shape task characteristics, such as objectives and priorities (Louviere, 1988; Keeney & Raiffa, 1993; Clemen, 1996), as well as perceptions of contextual characteristics, such as surrounding events and the approval of others (Simonson, 1989; Higgins, 1996; MacCarthy & Wilson, 2001; McKay & Wiers, 2003; Jackson et al., 2004).

**RESEARCH APPROACH**

The importance of schedulers’ decisions to the operations of a production and manufacturing organisation suggests scheduling practices critically influence the successful implementation of Lean strategy. However, scheduling in the context of adopting a new strategy has not been previously studied. Therefore, to uncover the assumptions that support or impede schedulers’ adoption of Lean strategy in the steel industry, case research was chosen. Case research is particularly valuable when the intention is to examine phenomena in their natural setting (Meredith, 1998), and it is a powerful approach that can provide a rich set of data on real-world practice (Eisenhardt, 1989; Voss, Tsikriktsis & Frohlich, 2002).
Case studies are used to explain phenomena when the researcher has limited, if any, control over events, behaviours, and conditions, and when the focus is on contemporary and contextual events (Yin, 2003). In addition, according to Yin (2003), case studies are appropriate when the research seeks to address “how” and “why” questions. The questions of this research are mainly interested in how and why Lean strategy is accepted or rejected in the steel industry, therefore suggesting case research is appropriate.

The type of case research employed in this study is a combination of a retrospective and longitudinal case study of a single company. This research perspective enables a thorough, in-depth analysis of the human aspects involved in the adoption of Lean strategy (Klein & Myers, 1999; Voss et al., 2002), by examining retrospective views of an unsuccessful attempt to implement Lean strategy. A major benefit of a retrospective approach is the reliability of the case’s selection, since the sustainability, of strategy implementation can only be evaluated in retrospect (Voss et al., 2002). To retrospectively examine the implementation of Lean strategy in a steel-manufacturing business unit, interviews with eight of the individuals involved in the implementation were conducted, and archival documents were examined.

A retrospective case study, however, is subject to the following potential problems (Voss et al., 2002):

1. Interview inaccuracies – participants may not recall important events, or their recollection may be biased. A particular problem is post-rationalisation: events are interpreted differently in hindsight, compared to how they were interpreted at the time.

2. Archival inaccuracies – archival data, such as meeting minutes and other documentation, may not always reflect the whole truth, as difficult or controversial items may not appear.

To address these problems, Voss et al. (2002) suggest employing a longitudinal approach. Therefore, contemporary scheduling practices in two of the organisation’s business
units were examined as well, in order to gain contemporary perspective on the forces that support
or impede Lean strategy. This examination was conducted through a second set of interviews,
which examines current influences on scheduling practices, by interviewing eight key
scheduling-team members from two different business units. In addition, documents relevant to
current scheduling practices were also examined.

The two interview sets were one year apart. The first set focused on an attempt to
implement Lean strategy several years prior to the time of the interviews. The second set was
concerned with contemporary scheduling practices, and factors influencing them. A thematic
analysis of the findings from both sets reveals five assumptions that support or impede Lean
scheduling practices, presented below.

RESULTS AND DISCUSSION

Decision-making literature does not always make a clear distinction between task-related
and context-related variables, since decision context often determines the decision task (Payne et
al., 1993). Indeed, the context in which scheduling decisions are performed in this study
determines the scheduling task. Contextual factors influence schedulers’ interpretation and
perception of constraints, priorities, and objectives. Therefore, contextual and task-related
factors are discussed simultaneously with the assumptions that influence their adoption of Lean
strategy. Each assumption is related to a different aspect of Lean strategy summarised in Table
2.

[INSERT TABLE 2 HERE]

Based on task-related and contextual factors, as well as direct quotes, five assumptions
are identified:

Assumption 1: The Source of Business Success

The source of business success relates to the perception of value. To support Lean
strategy, schedulers need to assume that business success stems from addressing customer
orders on time, rather than keeping low product-costs. This acknowledgement supports scheduling practices that reduce production lead times, at the expense of local efficiency and cost reduction. Indeed, previous findings indicate that a shared awareness of customer needs supports the adoption of Lean strategy (Nahm, Vonderembse & Koufteros, 2004), although this support was not directly linked to scheduling practice. The current study offers insight as per how the understanding of customer needs supports Lean practices. For example, when timely delivery is seen as important, it justifies stopping production, even though production stopping reduces the achievement of localised production targets. This assumption is interrelated with contextual need for justification of scheduling decisions (Simonson, 1989), as well as task-related prioritisation of objectives (Clemen, 1996).

**Assumption 2: How to Address Customer Demand**

Closely related to the previous assumption on the source of value is the assumption on how it is achieved. While the traditional approach emphasises the optimisation of core activities (such as sales and production), Lean strategy emphasises the coordination and synchronisation of these functions through collaboration.

A collaborative focus enables schedulers to influence the stakeholders involved in developing and enacting the schedule, and enables schedulers to balance cross-functional needs. Schedulers in process industries therefore facilitate the type of collaboration achieved in cells in discrete manufacturing. This focus can be encouraged through appropriate performance measures. When performance measures do not encourage a collaborative focus, and instead promote localised optimisation of core activities, they legitimise the focus of production units and sales representatives on their core activities. However, when the parties understand the importance of synchronising their efforts, they are more aware of their own impact on the overall business and supply chain. This awareness increases the acceptability of Lean practices, such as kanban adherence, that reduce localised achievements.
Assumption 3: The Role of Kanbans

Kanban adherence is strongly emphasised in literature as critical to the sustainability of Lean strategy (Ohno, 1988; Monden, 1994; Hopp & Spearman, 2004). Kanbans ensure paced production along the entire supply chain, and do not permit localised production peaks that do not take into account other production units. Kanbans also expose imperfections and problems in the production process, and thus facilitate continuous improvement (Billesbach, 1994). When this role of kanbans is understood and accepted, adherence to kanbans facilitates a sense of urgency to resolve the problem that stopped production.

In contrast, this study shows that implementing kanbans is insufficient for the sustainability and enactment of Lean strategy. If kanbans are merely assumed to be a guideline that indicates the state of inventory compared with planned budget, and if the kanbans are not strictly adhered to, they are not effective in supporting Lean strategy. Kanbans in these circumstances do not maintain paced production, and do not help detect problems that prevent it.

Contextual pressures to avoid machine stopping and to maintain high utilisation levels contribute to the assumption that a kanban adherence is optional. This assumption impedes the successful implementation of Lean strategy.

Assumption 4: How to Achieve High Production Volume

Lean strategy claims that high production volume can be maintained when small and standardised batches are constantly produced along the entire supply chain. These small and standardised batches lead to a predictable, stable, and consistent production pace. In other words, with Lean strategy, high production volume is achieved over time.

In contrast, an assumption that high production volume at every run results in high production volume overall impedes the adoption of Lean strategy. This assumption leads to the scheduling of large batches, which result in high inventory levels (Lieberman, Helper &
Demeester, 1999), and eventually leads to congestion and reduction of overall production volume (Simchi-Levi et al., 2003). When schedulers operate in an environment of unreliable equipment, they prefer large batches, as well as high inventory levels, to buffer unpredictable breakdowns. In addition, the saliency of feedback creates a different context for interpreting production results. When the consequences occur significantly later than the decision, feedback saliency is degraded (Croson & Donohue, 2006). Since in Lean strategy, high production volume is achieved over time, this achievement is not as salient as the immediate achievement of high production volume due to a large batch at a time. When large batches are scheduled, the successful production of large quantities is immediately visible. This asymmetry between the visibility of consequences of the two strategies impedes the adoption of Lean scheduling practices.

**Assumption 5: Length of Production Lead Time**

One of the major aims of Lean strategy is to reduce the time it takes to produce a product (i.e., production lead time) so it is as close as possible to the duration of actions necessary for production (i.e., value-add time) (Rother & Shook, 2003; Womack & Jones, 2003). In process industries, it is not uncommon to find value-add times that represent a small fraction (less than 5%) of the total production lead time (Shah, 2005). This enormous gap leaves ample room for improvement, and indeed, successful adoptions of Lean strategy in the steel industry report dramatic reductions of their production lead times. However, if schedulers (and other organisational members) assume these lead times are set, and cannot be changed, such a reduction is not likely to be achieved, as demonstrated in the case studied here. In this case, inventory is viewed as the only possible way to address customer demand. The efforts for improvement then focus on maintaining a high level of inventory, which can satisfy demand on time when orders are accepted, and when unpredictable breakdowns occur. Inventory as means of insurance is not uncommon (e.g., Davis, 1993); however, Lean strategy sets against this view.
of inventory, and aims to minimise the uncertainty that calls for such insurance. The acceptance of high inventory levels contradicts Lean scheduling practices, and thus impedes the adoption of Lean strategy.

LIMITATIONS

This study is based on a single company, which has its own set of practices, history, shared understandings, and economic conditions. These variables suggest that results may not be transferrable to other steel manufacturers. However, when examining the few reports available on Lean strategy implementation in the steel industry, many of these characteristics appears to be shared (Abdullah & Rajgopal, 2003; Harrison, 2005; Abdulmalek & Rajgopal, 2007; Storck & Lindberg, 2007). Other steel manufacturers share practical aspects impeding the adoption of Lean strategy in this organisation: unreliable equipment (Harrison, 2005) and monumental in size (Abdullah & Rajgopal, 2003), as well as saturated capacity (Abdulmalek & Rajgopal, 2007). In addition, other steel manufacturers share many human aspects which include frequent senior management turnover (Harrison, 2005), as well as pressures to produce in large quantities (Storck & Lindberg, 2007). Because the organisational variables influencing the findings in this study are representative of the steel industry, the results are transferrable to other steel manufacturers.

CONCLUSION

This study extends on current literature by highlighting the role of schedulers in the adoption of Lean strategy in the steel industry, and by identifying assumptions that are relevant to its successful implementation. These assumptions provide context for – and therefore influence – scheduling decisions. These assumptions are concerned with the source of business success, the way to address customer demand, the role of kanbans, the way to achieve high utilisation, and the length of lead times. Schedulers need an alignment between these assumptions and Lean principles to enact Lean strategy.
To achieve such alignment, schedulers’ assumptions need to be modified. Further research can examine the effectiveness of various methods and techniques to address and modify these assumptions, such as rational discussion, forced conformity, or inspirational appeals. Further research should also examine the extent to which these assumptions are shared amongst other member of the organisation, and the influence their assumptions have on schedulers’ decisions. If this shared nature of the assumptions also provides context (and therefore, influences) scheduling decisions, they may need to be modified as well. Future research into the influence of the assumptions of other stakeholders on scheduling decisions can complement the individual perspective presented in this paper.

Finally, this research demonstrates how to capitalise on past organisational events. Methodologically, this research contributes an approach that reinforces retrospective inquiry by adding contemporary examination of current relevant practices. This extends currently acceptable methods for theory development (i.e., multiple contemporary case studies and longitudinal case studies) to include case studies that combine a retrospective and contemporary approach. Further refinement and development of this research method can add to existing research techniques and enhance learning from past organisational experiences.
### Table 1: Principles and assumptions of Lean and traditional strategies

<table>
<thead>
<tr>
<th>Principle</th>
<th>Lean Strategy</th>
<th>Traditional Strategy</th>
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<tbody>
<tr>
<td>Value</td>
<td>Customer-centric</td>
<td>Cost-centric</td>
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<tr>
<td>Resulting assumption:</td>
<td>Quick delivery</td>
<td>Scale economies</td>
</tr>
<tr>
<td>main priority</td>
<td></td>
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<tr>
<td>Optimisation</td>
<td>Overall</td>
<td>Localised</td>
</tr>
<tr>
<td>Resulting assumptions:</td>
<td>Small batches</td>
<td>Large batches</td>
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<tr>
<td>production strategy</td>
<td>Paced production</td>
<td>Localised optimisations</td>
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<tr>
<td>(kanbans)</td>
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<tr>
<td>Overcoming problems</td>
<td>Continuous improvement</td>
<td>Episodic improvement</td>
</tr>
<tr>
<td>Resulting assumption:</td>
<td>Low WIP exposes problems</td>
<td>High WIP buffers problems</td>
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<tr>
<td>WIP management</td>
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<tr>
<td>Assumption</td>
<td>Supporting</td>
<td>Impeding</td>
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<td>------------------------------------</td>
<td>---------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------</td>
</tr>
<tr>
<td>The source of business success</td>
<td>The source of business success is addressing customer demand on time</td>
<td>The source of business success is production of quality product with low costs</td>
</tr>
<tr>
<td>How to address customer needs</td>
<td>Collaboration between functions is necessary to best answer customer needs</td>
<td>Optimising each function’s core activity best answers customer needs</td>
</tr>
<tr>
<td>The role of the kanban</td>
<td>Kanbans support the reduction of WIP and help achieve perfection</td>
<td>Kanbans are an indication of inventory levels and inventory costs</td>
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<td></td>
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<tr>
<td>How to achieve high production volume</td>
<td>High production volume is achieved by perfecting core activities and changeovers</td>
<td>High production volume is achieved by high utilisation and large batches</td>
</tr>
<tr>
<td>Length of production lead time</td>
<td>Production lead time is not far greater than order lead time</td>
<td>Production lead time is far greater than order lead time</td>
</tr>
</tbody>
</table>
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