

# Leaning into the Steel Industry: Lean supply and the Steel Industry

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## ABSTRACT

The steel industry contributes substantially to Australia's economy. However, globalisation has forced steel producers and exporters to reassess their strategic direction and seek out different management approaches to maintain market share. This paper promotes the concept of lean supply and its effectiveness (when used in conjunction with other strategic tools), in responding to the challenges of globalisation and other changes in the operating market; by strengthening the industrial supply chain for competition. Future considerations for practitioners and researchers are identified in the concluding discussion.

*Keywords: Lean, supply chain management, steel industry.*

## INTRODUCTION

The revenue of steel currently stands at approximately \$13.9 billion per annum for Australia (IBIS 2005), addressing a domestic and international demand. However, global competition is fierce, particularly due to mergers between the largest manufacturers. Examples include the European Arcelor-Sevestal merger, and the formation of BHP Billiton in Australia. These 'super players' have dominated market share, creating the need for the remaining firms to review the importance and effectiveness of internal operations and external alliances. Larger firms operating in the Asia Pacific region must retain their position in the face of emerging competition from previously closed economies such as India and China. Mergers between some of the largest companies has put pressure on smaller scale operators to rethink their long term strategies in order to remain in business.

As a result, commodities have experienced high demand, creating competition between organisations trading in these essential products with huge losses if they cannot maintain their position. Increasing

competition means it is wise for existing providers to not only maximise the efficiency and effectiveness of their respective supply chain, but to leverage any strategic or competitive advantage they may already possess (such as existing supply alliances, proximity to demand/established consumer base etc.).

Well managed strategic alliances and consolidation are viewed as essential to provide long term sustainability and growth. Mergers such as Arcelor/Sevestal, creating the World's largest steelmaker (BBC, 2006) and BHP/Mitsubishi create real potential for those involved. Sevestal benefits from a platform into the global arena, while Arcelor can use their new found size to avoid hostile takeovers, while BlueScope Steel (Malaysia) Sdn Bhd's joint venture is being used to break into more diverse markets so as to reduce dependency on current areas of business (Li, 2006). According to (Boyle, 2006b) this will have substantial bearing on the supplier base of these supply chains, as "Steel producers look to secure supply by investing in equity stakes or takeovers of raw material producers"

Through the adoption of lean thinking (Womack and Jones, 1996) it is possible to drive cultural change, and experience increased flexibility to customer demand. Examples of this approach within the steel industry stretch from the value stream mapping of supply chain operations (Brunt, 2000) to the application of lean techniques within the purchasing function of a steel plant (Roy and Guin, 1999).

The development of the lean approach to manufacturing began shortly after World War II, pioneered by Taiichi Ohno and associates, while employed by the Toyota motor company. Forced by shortages in both capital and resources Eiji Toyoda, the then president of Toyota, instructed his workers to eliminate all waste with the aim of producing the same or better value at minimum cost. Waste is defined, according to (Russell and Taylor, 2000) as "*anything other than the minimum amount of equipment, materials, parts, space and time which are absolutely essential to add value to the product*".

The lean vision as put forward by (Womack and Jones, 1996) focuses on the individual product and its value stream, identifying which activities and processes are value added and non-value added, and to enhance the value and eliminate all waste in all areas and functions within the system. Another main element behind the Toyota Production philosophy is to maintain the continuous flow of products in systems, so that demand changes will not cause disruption to the system. Following the refined and methodical integration of these practices, the Japanese went on to achieve a total, new manufacturing paradigm, that became the dominant production model to emerge from a number of production improvement concepts around at the time (Katayama and Bennett, 1996).

## **LEAN SUPPLY**

It is possible for an organisation to implement lean without its suppliers operating to the same working principles, but the result is a fractured pull system that doesn't adhere to the true ideals of lean. Moving towards key lean ideals like one piece flow would be impossible, and many forms of waste would still be present. It is evident that to become truly flexible and responsive to customer demand, or economic fluctuation, lean principles must extend along the supply chain, providing the basis for further improvement initiatives. In other words, when applied locally, lean philosophy itself isn't enough to guarantee sustained market share, and doesn't automatically lead to the lowest cost solution (Jones et al., 1997).

One notable scenario that emerges in non-lean supply chains is that any larger organisation within it, will rely on the flexibility of their suppliers in order to fulfil their customer demand, and because of their dominance, management choose to operate inflexibly and not as equal in the chain demanding themselves (Bamber and Dale, 2000). To improve on this situation, total visibility of needs is required between suppliers and their customers, in order to break the cycle of reactive fulfilment of orders, and remove any obstacles to create a truly lean enterprise (Tinhnam, 2005b).

The essence of lean supply was first put forward by (Lamming, 1993):

*“The state of business in which there is dynamic competition and collaboration of equals in the supply chain, aimed at adding value at minimum total cost, while maximising end customer service and product quality.”*

Improving inefficiency and achieving any state towards lean ideals is not easy (Anon., 1997). However, to address the journey towards becoming a lean supply chain must be first based upon a good level of cooperation and understanding internally throughout the individual supply chain nodes, and externally, about the initiative, between the final assembly plant and the first tier suppliers. This in turn should lead to cross communication and supplier associations evolving, creating an environment where all parties undertake research and development for the greater good – creating a knowledge bank of strategic and operational information that is available to all, enabling the production of superior products. Once on its way to being established, this lean culture can then lead to all nodes within the supply chain driving towards maximising efficiency, flexibility and more strategic management focus. As noted by (Srinivasan et al., 2005) “properly executed, lean is an effective growth strategy”.

The formation of such alliances is of course essential for the establishment of competitive, responsive supply chains. In addition to this long term strategy, it is critical not to forget the competitive leverage that can be gained from efficient and effective operations on a micro level (i.e. within individual supply chain nodes). With the current price of steel and iron ore being particularly high, this increase in plant efficiency will lead the way in providing relief from the tension suffered as a result of high costs and utilisation levels.

As suggested, to achieve the above, the differing interests and attitudes of all parties involved must be examined and understood to be successful (Lamming, 1996). The comprehensive implementation of

lean is certainly not an easy one to extend along the chain. The research of explores the development of lean supplier networks and the structure of supplier associations necessary to develop a lean supply chain, while (Hines et al., 1998) examine the benefits that can be achieved through the integration of strategic alliances. provide further insight into the development of supplier relationships, emphasising the fact that if each partner within the supply chain comes to some sort of long term commitment to the other parties involved, it would be mutually beneficial to everyone.

Visibility is key to the establishment of effective supplier networks and strategic alliances, and trust is critical to establish this visibility (Kale et al., 2001). Due to the vast amounts of data involved in the creation of a ‘transparent’ supply chain, the role of information technology is imperative to establish real-time supply chain visibility, replacing material flow with information flow (Langfield-Smith and Greenwood, 1998, Kwon and Suh, 2005).

At a micro level, examining the value stream of a product within a system can achieve a certain degree of improved efficiency, but in order to comprehensively address the value added activities from procurement of raw materials through to manufacture, product delivered to customers, it is necessary to consider the macro level operations, or in other words the total value stream. This extends in both directions along the supply chain, and considers every activity that the product or service encounters. (Gort, 2005, Tinham, 2005a) consider the importance of the total value stream of a product family, and illustrate the true scope of a value stream in the diagram below:

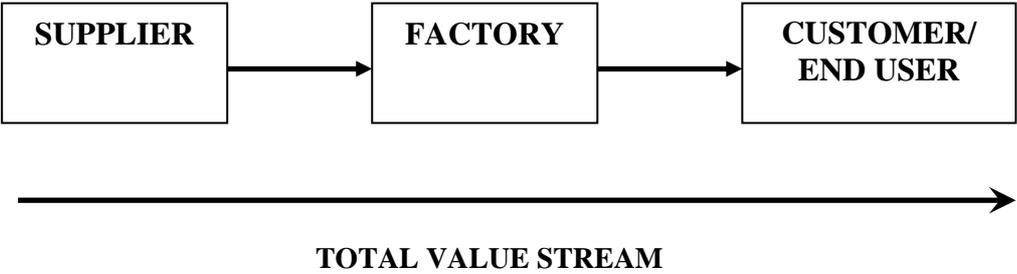


Figure 1. Value Stream Scope

Figure 2. below extends the illustration in Figure 2. (Taylor and Brunt, 2000) from the individual system to the complete supply chain, with lean principles underpinning the concept of agility. Where lean addresses efficiency, and agility addresses flexibility. This is best described by :

*“Agile calls for a high level of rapid reconfiguration and will eliminate as much waste as possible, but does not emphasise the elimination of all waste as a prerequisite. Lean manufacturing states that all non-value adding activities, or muda, must be eliminated. The supply chain will be as flexible as possible but flexibility is not a prerequisite to be lean”.*

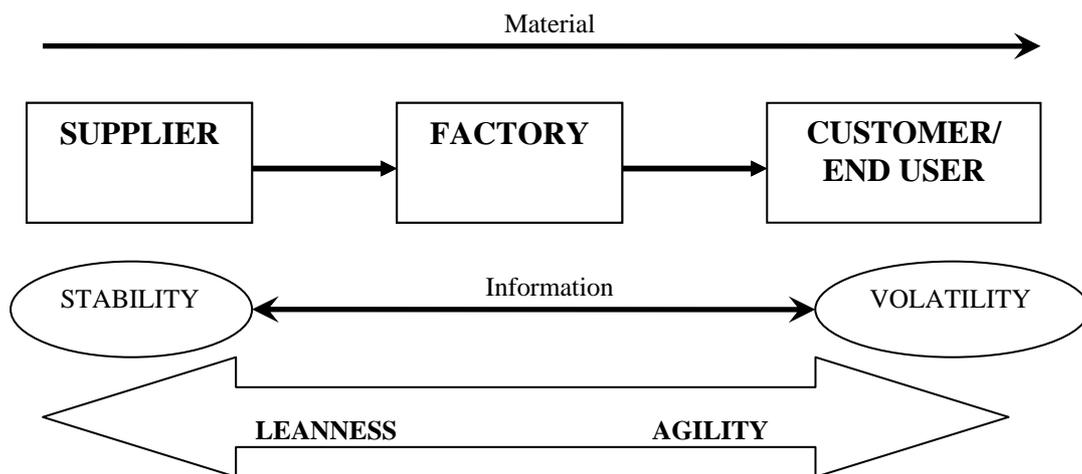


Figure 2. Leagile Map

The concept of agility centres on four key points outlined below:

- 1) Delivering value to customer
- 2) Being ready for change
- 3) Valuing human knowledge and skills
- 4) Forming virtual partnerships

(Taylor and Brunt, 2000)

As (Taylor and Brunt, 2000) points out in his extensive work on the concept, lean is necessary but in itself not sufficient to achieve agility. (Naylor et al., 1999) provide insight into the synergies of agility and leanness, and suggest that leanness is achieved through the application of agility. It can be discerned from this that a system must be operating efficiently before it can be aligned to enter niche markets and cater for ever more demanding customers (Katayama and Bennett, 1999).

Instead of regarding lean and agility as individual philosophies, it has been discussed most notably by (Kidd, 1994), (McCullen and Towill, 2001), and (Robertson and Jones, 1999) among others; that the two approaches in fact compliment each other, forming the new paradigm of 'leagility' (Naylor et al., 1999).

When only lean techniques are applied, they will lend themselves to functional, predictable markets (low variety high volume) (Prince and Kay, 2003). Conversely, when the concept of agility is also introduced, the two tools together, will lend themselves to both the functional, predictable markets, and the volatile and niche markets (low volume high variety). These volatile markets hadn't yet been able to fully realise the potential gains from lean.

Both lean and agile paradigms need to be part of a total supply chain strategy (Huang et al., 2002). The key to the alignment of lean and agile paradigms revolves around achieving the correct balance of the two throughout the supply chain Figure 3. also shows how the balance between the two concepts varies along the supply chain structure.

## **LEAN STEEL**

The global consumption of steel is set to rise approximately 3.7 percent annually until 2011 following rapid economic growth in China and India, along with renewed demand in the USA. Consequently, stock levels are predicted to increase within supply chain nodes, where organisations ill-adjust by increasing their capacity for inventory but not the efficient flow of material through the supply chain (Naylor et al., 1999).

Awareness of the potential benefits and necessity for lean operations in the steel industry has increased over the last ten years. Supply chain management was a relatively new philosophy within the steel industry at this time, but it was recognised that in order to experience substantial savings, steel producers should be able to strip away the excess expenditure from the bottom line. It was noted that

*“To lower outlays for materials and supplies, producers must reduce maintenance, repair and operating inventory, manage the product mix more efficiently, optimise freight systems, and create value-billed processing”* (Childerhouse and Towill, 2000)

This is underpinned through the work of (Naylor et al., 1999) who summarise the evolution of supply chain focus within the steel industry according to Steven’s model for supply chain evolution (Boyle, 2006a). (Dickey, 1997) take this further by discussing how far the steel industry has come in the last decade or so. In brief, the first three stages of Stevens model have been addressed through the introduction of lean thinking and similar philosophies of continuous improvement. Therefore, the last stage in the evolution for supply chains is the fully integrated model, whereby total transparency throughout the supply chain is achieved through effective transfer of information between the separate nodes, coordinating their behaviour to achieve high levels of customer service.

In the middle of the last decade, enabling technologies such as ERP and the internet pushed communication boundaries forward (Potter et al., 2004), meaning that transparency, and effective relationships were easier to establish, providing the foundation for fundamental improvements at all levels of operations to be driven forward. Projects such as the Lean Processing Program, which

considered the upstream automotive market (with British Steel analysed as part of the supply network) (Stevens, 1989) brought attention to the scope of competitive advantage leveraged from the total understanding of value creation in the supply chain.

However, although lean ideal is that of a philosophy wholly adopted as a culture of continuous improvement throughout the complete supply chain enterprise, substantial benefits can be experienced through the focussed application of lean techniques to particular business functions, with a view to establishing lean operations at a base point for expansion and as a demonstration of the improvements to the rest of the business units. (Potter et al., 2004) explore the application of just-in-time (JIT) principles to the purchasing function of an Indian steel plant, using freight consolidation to obtain JIT delivery from suppliers. It should be noted that there must be a comprehensive strategic plan for the consolidation of freight, requiring careful selection of suppliers and quality levels, in order to build and maintain effective alliances, so that material is there when required, in the correct amounts at the correct time so as to provide the customer with the value they expect.

The need for cost reduction has traditionally driven the need for most improvement initiatives. However, due to the fact that customers are becoming more demanding, empowered by a continuously expanding choice of suppliers (a result of globalisation), customer service has recently emerged as a driver of change (Dickey, 1997). This situation is compounded further still by the fact that the steel industry is subject to constant price fluctuation of its product as a result of being a commodity, and therefore directly affected by volatile environments such as political unrest, war, and forever increasing oil prices. Providing a value efficient product does not provide enough of a competitive stance to solely rely on efficient processes. Organisations need to go extend their service beyond the traditional product, perhaps bending to customer requirements even more through the finishing of the product (coatings etc.) or look at providing enhanced customer service.

## **DISCUSSION**

It is important to recognise that lean has moved away from being a one-stop cure all philosophy. Instead, it should be seen as the platform for the initiation of cultural and operational change, leading to total supply chain transformation. In other words, it forms a small but important piece of the jigsaw. When used in combination with other complimentary continuous improvement techniques, lean provides leverage for comprehensive strategies and therefore provides a more integrated, coherent and holistic approach to continuous improvement. Lean must be viewed, understood, and accepted as a coherent methodology and therefore a step beyond previous ad hoc continuous improvement strategies. It should be seen as a precursor to more producing more responsive supply chains through effective communication leading to strategic alliances and visibility. Organisations will need to be as lean as possible so that they may move forward to additional concepts such as agility and total supply chain integration. This is not to say that every element of the lean philosophy should be adhered to, as not every lean tool or technique is suitable for every situation or company. The time and resources spent on an individual technique can sometimes outweigh the gains realised and therefore not be feasible. It is evident from research that both a hard and soft approach is necessary for a successful implementation, and the correct synchronisation is critical.

## **CONCLUSION**

Much of the inherent mistrust surrounding lean as a philosophy is due to the limited and myopic way that it has been implemented. For example, reducing inventory levels cannot be enforced in volatile environments, usually leading to even greater variability and exposure to risk. Therefore, a systematic approach needs to be adopted which optimises the whole system and focuses the right strategies in the correct places – i.e. working towards creating “leagile systems”.

Lean is still a relatively immature area of research, especially within process industry applications. The next stage of research should be to address the management issue concerning the resistance to communication flow and cultural change when implementing any such initiative. Leadership is also a major factor in the creation of vision, strategy and ultimately success in any implementation of such efforts, large or small. Effective internal relationships must be developed and maintained in order to create a truly lean, efficient and responsive enterprise able to compete with strong global competitors.

Steel producers must use these techniques to identify their core business needs and align their products and/or services to gain the maximum leverage. As put forward by (Brunt, 2000) organisations must be make the transition from product-orientated business to service orientated business, providing life cycle solutions to their customers, and ultimately reaping the benefits.

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