

POMS Abstract Reference 007-0148

A Holistical Manufacturing Strategy (HMS) for Sustainability within a Specialist Manufacturing Company

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POMS 18th Annual Conference
Dallas, Texas, U.S.A.
May 4 to May 7, 2007

Abstract

For companies to remain competitive in an increasingly demanding global market, they must discover innovative ways in which to work effectively whilst ensuring that new markets are penetrated and sustainable growth is achieved. Sustainability not only requires companies to provide competitively priced products but it must develop innovative strategies to enhance market share through new product development etc. This now places a further burden on companies and therefore a holistic manufacturing strategy must be developed in order to ensure that the factory of the future is able to meet this new demand. This paper proposes a holistic manufacturing approach which integrates the manufacturing efficiencies achieved through Lean and Agility, with the need to break into new markets through effective marketing and product innovation strategies such as, FEA as a part of a NPI/D program. Through a series of measures it can be partially

proven how successful it will be and how the company will strengthen and achieve long term economic sustainability.

Keywords: Operations Strategy, Lean Manufacturing, NPD/I, FEA, Sustainability.

Introduction

This paper will explore and analyse the methods and potential benefits for a specialist manufacturing company seeking to achieve sustainability. It is being proposed that if Wall Colmonoy Ltd reduce their running costs, make bottom line savings as well as increase their sales they can successfully achieve a strong future ahead of them. The methods chosen to carry out this objective will be the introduction of lean manufacturing principles and NPD/I (new product development/introduction) into the current manufacturing and company systems.

Wall Colmonoy Ltd is located in South Wales, U.K. They are part of a multi-national organisation with plants situated in U.S.A, France and Canada. The Company was established in 1938 at the head quarters of the Wall Colmonoy Corporation, Madison Heights, Michigan, U.S.A.

Since the company was established it has managed to tap in to a number of specialist markets by offering a wide range of products and processes based around their own patented cobalt and nickel based alloys. Some of these processes include casting, machining, brazing, welding, and powder atomizing. The sectors/industries in which

these processes serve are Glass, food, aerospace, rail, automotive, motor racing, gas turbine, and military.

The company has enjoyed significant success over many years due to the niche market position. However, in recent years, companies operating from low labour cost countries are operating right within Wall Colmonoy's market sector and are applying direct competitive pressure that risks Wall Colmonoy's senior position within the industry. These companies are able to offer far cheaper products but lack the knowledge and skills to supply on time parts of the same quality. It is only a matter of time before these foreign companies will gain that experience and will start matching Wall Colmonoy Ltd on quality and beating them on price.

A successful business is based upon low costs whilst developing their sales volumes through innovative product development and capturing new high value markets. Any company that runs with high manufacturing costs will always be in danger of running at a loss. This can easily happen if the sales within a company fail to increase or even decline. An ideal company would have a successful plan in which to reduce waste and costs, and also have a good strong plan in which to sustain a steady trend of ever increasing sales.

If sustainability is not achieved then there is imminent danger ahead that shows a rise in running costs against a fall in total sales, see figure 1. When sales and cost are moving in the same direction the profit margin will stay constant, as shown in figure 2.

This is acceptable but not ideal. A company looking to achieve sustainable growth would be expecting costs and sales to be moving in opposite directions, see figure 3.

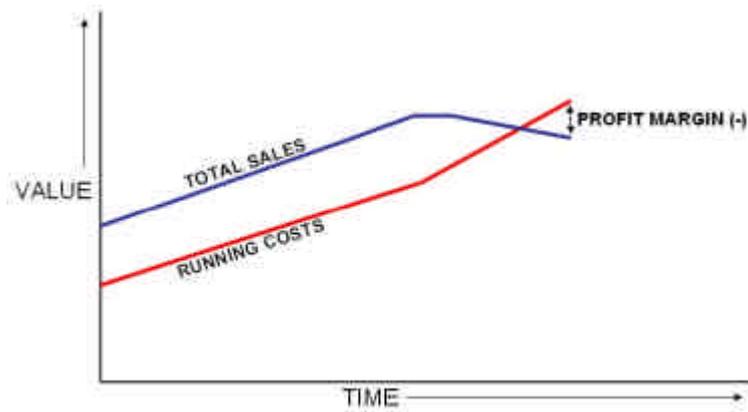


Figure 1, Sales and costs moving in opposite directions, negative profit margin



Figure 1, Sales and costs moving in opposite directions, negative profit margin

Figure 2, Sales and costs rising steadily to give a constant profit margin, no growth



Figure 3, Sales and costs moving in opposite directions, increasing profit margin.

The one connection throughout the entire company are the links to Quality, Cost and Delivery, and flexibility (QCDF). This offers a clear structure for continuous improvement, raising levels of customer satisfaction and greatly improving the management of production. QCDF is not, however, sector-specific. These key measures can be applied to improve production performance throughout manufacturing industry from the auto-industry to semi-conductors, electronics, aerospace, telecommunications, textiles, building products, food and chemicals processing (autoindustries.com). QCD is often thought of as an acronym in its own right, but for the purposes of this paper the authors have included flexibility 'F' as an added factor. QCDF (Quality, Cost, Delivery and Flexibility) need to be considered as key business priorities. Each of the four elements is linked to different aspects of the business and depending on the requirements of the process or the market place it is essential that a strategy is in place to get the balance right and achieve sustainability.

Why Wall Colmonoy Ltd Need the Introduction of Lean Manufacturing

In the continuous pursuit of increased profitability more and more companies are turning to lean manufacturing to reduce or eliminate waste in their production processes. At one time lean manufacturing was confined to the automotive industry, but now many lean principles are becoming a standard procedure in a wide range of industries. The reason for this is simple: When implementing with a good performance management system, lean principles have a proven track record of operational and strategic success, which results into increased value to the customer (IFS white paper 2004).

Through tackling the issue of waste reduction, and successfully implementing many of the principles of lean manufacturing, Wall Colmonoy Ltd can potentially achieve (where were these figures obtained) (maybe better to say significant improvements can be derived in the areas of :

- Overhead operating costs reduced
- Sales £/employee higher
- Sales doubles
- Profits 4 x
- Lead time cut
- Process queues
- Improved working environment

(Lean manufacturing, www.pqa.net)

The principles of lean manufacturing that are likely to have the most success on the companies long term goals would be, a 5's program to organise the work area reducing downtime through having all the correct equipment and tooling available when needed

and knowing where work is at all times throughout production. SMED (single minute exchange of die) will tackle the setups of each machine breaking each setup in to smaller parts to analyse what is necessary and what's not, also how time can be saved by carrying out some activities during the operation. VSM (value stream mapping) can map the flow of the work through production; it can highlight any idle time, wasted transportation and incorrect routes. Planned and preventative maintenance as part of TPM can ensure that all machines are in service for as long as possible by reducing major breakdowns. These areas of lean manufacturing will be implemented in a real manufacturing environment such as the machine shop and foundry producing a wide variety of components.

The manufacturing areas in which these lean systems can be implemented are not high volume production lines as you would find in automotive manufacturing, but more a high volume jobbing shop. The meaning behind high volume jobbing shop is that there are a wide variety of different parts that are cast and machined in medium to high quantity batches. These batches high enough to justify using CNC machines, and the investment casting process, but aren't large enough to set up a continuous production line. Therefore it will be more difficult to make large savings from single improvements as the work is forever changing. There needs to be many improvements made to see the difference in bottom line savings.

With the type of product mix Wall Colmonoy Ltd has to manage it becomes important that organisation the work area, setups and work flow are tackled. On average each machine will setup on a new operation 3 times over a 24 hour period, with an average setup time being 1 hour. With this in mind it becomes a major issue if setups are delayed

and equipment can not be found. CANDO, SMED, VSM, and Planned/Predictive maintenance will become important tools in order to reduce the overall running costs of the companies manufacturing systems.

By considering what can happen in a worst case scenario, a company looking at decrease their costs and waste by becoming lean could unintentionally put themselves in a far worse situation than before the changes if not managed correctly. In the past limitations to lean manufacturing has appeared when practices and techniques were taken to the extreme. Traffic congestion due to frequent deliveries, forcing suppliers to produce in smaller and smaller batches (Cusumano, 1994). Richards (1996) contends that lean producers set their sights explicitly on perfection: continually declining costs, zero defects, zero inventories and endless product variation. To do this without placing equal emphasis on improving interaction with sales can be dangerous. This could happen by losing a significant number of sales through poor delivery and quality performance, and incur higher costs covering problems that have arisen through the company becoming too lean, therefore losing flexibility. This flexibility for some companies is an attribute that serves them well and if they were to lose this attribute to their business it could have drastic effects (figure 43).



Figure 43, Sales and costs moving in opposite directions, negative profit margin

Considering both the advantages and disadvantage of introducing lean manufacturing into Wall Colmonoy Ltd it is obvious that it depends on how it is managed. In the case of Wall Colmonoy Ltd a degree of agility needs to be adopted to manage the constant changes within the industry they are competing in.

How Wall Colmonoy Ltd can successfully introduce FEA using NPD/I

The ability to introduce new products and services within a company will always have an effect on the company's ability to obtain new contracts and customers, hence resulting in higher sales if successful. When a company decides to commit to a new area of work, a structured approach is needed.

NPD/I is fast becoming a way of managing it. In business and engineering, new product development/introduction (NPD/I) is the term used to describe the complete process of bringing a new product/process or service to market. There are two parallel paths involved in the NPD process: one involves the idea generation, product design, and detail engineering; the other involves market research and marketing analysis. Companies typically see new product development as the first stage in generating and commercializing new products/processes within the overall strategic process of product life cycle management used to maintain or grow their market share. There are several general categories of new products/processes. Some are new to the market, some are new

to the company, and some are completely novel and create totally new markets. When viewed against different criteria, some new product and process concepts are merely minor modifications of existing products and processes, while some are completely innovative to the company. These different characterizations are displayed in the following diagram, figure 5. (NPD,wikipedia.org).

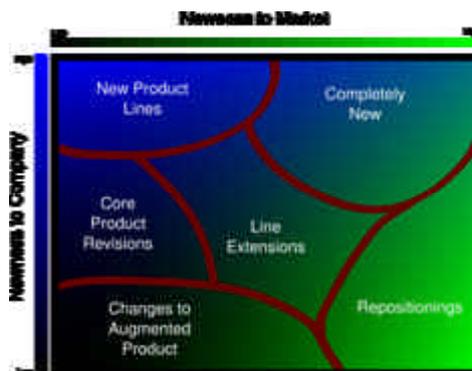


Figure 5, How new products/processes fit into NPD/I (NPD,Wikipedia.org)

One option open to Wall Colmonoy Ltd is the introduction of a new process called FEA (Finite Element Analysis). FEA consists of a computer model of a material or design that is loaded and analyzed for specific results. It is used in new product design, and existing product refinement. A company is able to verify that a proposed design will be able to perform to the client's specifications prior to manufacturing or construction. Modifying an existing product is utilised to qualify the product for a new service condition. In case of structural failure, FEA may be used to help determine the design modifications to meet the new condition(dermotmonaghan.com 2004).

In this case Wall Colmonoy Ltd can use FEA to attempt to prove the benefits and properties of a repair strategies and new and existing products. FEA is thought of as a

service that requires high skills and major benefits. Considering Wall Colmonoy current product range, there's a possibility of creating a department or spin-off company, which would have the ability to prove some of the claims in performance of their current product line. By introducing this service/product, and making it available to their customers, Wall Colmonoy Ltd are then likely to form a relationship far earlier in the process with their customers, even at the design and prototype stage. Customers are then likely to think of Wall Colmonoy Ltd as more than a supplier but a partner in product development. The introduction of this process would also provide a service that differentiates them from their current competitors.

For FEA to be introduced and developed successfully within Wall Colmonoy Ltd it would be advantageous if they were to follow a NPD/I system which will ensure that they are covering all aspects of the new process introduction. Wall Colmonoy Ltd will have to go through a set process when following a NPD/I program, this should to answer many questions about whether FEA as a viable option, both financially and commercially. By using business analysing tools they will determine if the introduction of such a process will work.

Simultaneously Applying Production Improvement Techniques with Business/Sales Enhancers to Achieve Sustainability

By linking the Quality, Cost, Delivery and Flexibility with the business enhancers and the production improvement techniques (Figure 6), Wall Colmonoy Ltd can develop a strategy to achieve their objectives of creating sustainability and increased profit margins

by using this strategic business model, it was proposed by the authors as a method to achieve sustainability

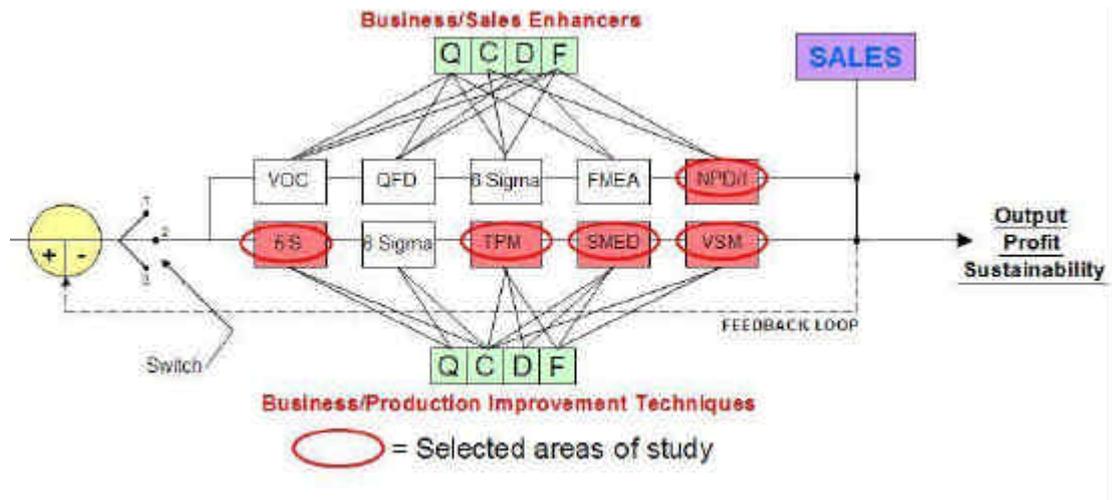


Figure 65. The Proposed Strategic Business Model

The model in figure 65 shows the links to QCDF to both the business enhancers and production improvements. By following the proposed strategy of introducing NPD/I and lean manufacturing systems successfully and simultaneously (figure 6), it is possible to see what benefits that can be achieved (figure 7).



Figure 7, Potential profit margin increase by adopting the strategic model

Each of the individual systems shown in figure 4, are linked to Q.C.D.F. depending on what needs to be achieved or what type of customer is being focused on. Each system will become more essential than another in every different case. There is also a three point switch on the strategic model that can be used to adjust the balance of systems used. A strategy that requires a bias amount towards production improvement techniques would indicate that the switch is in position three. Alternatively if there were a strong bias towards the business enhancers, switch position one would be active. For the strategy being proposed for wall Colmonoy Ltd the switch is positioned on number two, showing a mix of business enhancers and production improvement techniques such as, NPD/I, 5's, TPM, SMED, and VSM.

Customers are likely to start gaining from a new level to their relationship with the Wall Colmonoy LTD, potentially resulting in an increased number of production orders and new development work. It was essential that the strategic business model was created to give a visual representation of the two sides of the business that effects growth and sustainability. By selecting different systems to match the company's objectives, different results can be achieved.

Identifying and Calculating Potential Financial Gains

To analyse how successful the introduction of the new systems will be, a number of KPI (Key Performance Indicators) as well as other well recognised industry measures can be used.

The types of KPI that are being proposed are, OEE (Overall Equipment Effectiveness), this measure is commonly used as a measure in TPM under the umbrella of lean manufacturing. OEE is an effective way of measuring production output, setup times, and downtime. The three factors used to calculate OEE are availability, performance, and quality. By plotting the results over a weekly, monthly, quarterly and annually time period it will become clear how much Wall Colmonoy Ltd have improved on each of the three factors. The second of the proposed KPI to be used is the DTI (Department Trade and Industry) manufacturing advisory service. This KPI has been devised as a Microsoft Excel file. By entering the answers to a series of questions relating to company profile, diagnostic structure, workplace organisation, visual management, equipment/maintenance, changeovers, operator skills, quality systems, flow, team working, and process improvements before beginning to follow the proposed strategy, and then comparing the data again on a weekly, monthly, quarterly and annual time period, Wall Colmonoy LTD will then from this KPI be able to see which areas have improved to then calculate the amount of bottom line savings made. The third of the proposed KPI to be used is based upon customer feedback questionnaires and interviews against company sales. It will only be possible to show how much impact and to what extent the introduction of a new process such as FEA has been by using this data. These four measurements should give a different perspective on how well the systems have been implemented.

Business Opportunities

If Wall Colmonoy Ltd is successful in introducing an FEA department, it would open up new opportunities to branch off into its own independent subsidiary of the Wall Colmonoy Corporation. They could then increase their number of employees, manage their own finances and even start working on development and design work for focused customers rather than Wall Colmonoy Ltd existing ones.

Another potential benefit would be for the other departments within Wall Colmonoy Ltd. They may benefit from the developments of an FEA department, as well as other Wall Colmonoy plants around the world.

There could be an increased number of new customers which have come to Wall Colmonoy LTD after becoming aware of their new service within the design stages of products. Customers who may be researching a new supplier base may find themselves approaching Wall Colmonoy LTD, where before they may not have. Wall Colmonoy LTD will also have opportunity to make a name for them selves within a new market.

General Conclusions

Wall Colmonoy Ltd has an opportunity to gain a significant advantage over their competitors within the next few years as long as a decision is made to follow a well planned strategy. The authors of this paper have proposed a possible method to achieve sustainability and growth. The proposed plan involves both business enhancers, and productivity improvement techniques. Some of these systems can be implemented with low investment where as others such as FEA need a strong financial backing. Whichever systems are chosen, they must have an objective that is followed from start to finish

The key to their success will be the management of the implementation of whichever systems they chose. As stated earlier in this paper any company can find themselves in worse position by changing their systems if they do not achieve what is needed. Lean manufacturing has many advantages and possibilities within any industry, but it will only be successful if implemented correctly. It is essential that the individuals driving the changes have the sufficient knowledge to train and educate the whole workforce. Lean is a change of culture within a company, and although many savings are made from improvements at a shop floor level it needs to be supported from a higher level of management. Another aspect to consider is that not all companies will be compatible with an entirely lean process. Some companies will need to maintain a degree of flexibility and agility. This does not mean that it is one or the other but what is important is it is recognised which areas or processes will benefit most from the changes.

If Wall Colmonoy LTD were to embark on an introduction of a FEA department there are a number of issues that would need to be address other than its viability on a business point of view. A service such FEA requires a highly trained team to carry out the work. Highly trained individuals brought in to work on a FEA package may need to be paid on a different pay scale; this in itself can potentially cause problems on a personnel side.

Lean manufacturing has been around for many years and has gone through a number of different face lifts, FEA however over the past 15 years developed increasingly to a point where it often relied upon. Considering the differences between the two, it has been

proven in this paper that if the two areas of work are simultaneously applied they can help a company achieve sustained growth

Acknowledgments

We would like to thank everyone at Wall Colmonoy Ltd and Cardiff Business School, Cardiff University for the resources made available and the information we have received to enable us to write this paper.

References

1. Cusumano, M. A. (1994). "The Limits of Lean." Sloan Management Review, 1994.
2. www.autoindustry.co.uk/fatures/qcd
3. IFS Whit Paper, www.ifs.com lean manufacturing, 2004
4. Mary Poppendiek, principles of lean thinking, 2002, www.poppendieck.com
5. Richards, C.W. (1996), "Agile manufacturing: Beyond lean", *Production and Inventory Management Journal*, Vol. 37, No. 2, pp.60-64.
6. New Product Development, www.wikipedia.org
7. [www.dermotmonaghan.com/feInformation/introduction 2004](http://www.dermotmonaghan.com/feInformation/introduction%202004)
8. Lean manufacturing. www.pqa.net