Innovative Strategic Planning for the Design of a High Volume Production Line using Quality Function Deployment and a Batch: Flow Production Analysis

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ABSTRACT

This paper proposes an innovative factory planning methodology to achieve the objectives that were defined by Flexitallic for the future expansion of the Thermiculite production line. The concepts under investigation extend to the analysis of flow benefits and restrictions considering product features and demands addressed in a proposed Batch/Flow Comparative Matrix. Furthermore, this paper introduces the Quality Function Deployment (QFD) concept to support the manufacturing line design using a mechanism of incorporating commercial awareness in all stages of the product deployment. The original QFD ensures process planning by bringing parts deployment into parts characteristics through the House of Quality. This study renews the original QFD by developing the Strategic Alignment of Quality Function Deployment (SAQFD) to achieve proactive management of Houses III and House IV. The case study demonstrates the utilization and applicability of the proposed methodologies, and demonstrates their importance during the design of a high volume production line.

Keywords: Flow Line Design, Process Development, Product Development, Quality Assurance System, Quality Function Deployment

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INTRODUCTION: MARKET AND MANUFACTURING SYSTEMS

Manufacturing has radically changed over the past decade because the relatively ‘static’ nature of market has been replaced by highly changeable market requirements. The demand fluctuations are hardly satisfied by the inflexible mass production system, so new terms and requirements to manufacturing are fundamental. Kidd emphasizes in Crute (2003) every organisation needs to be able to switch frequently from one market-driven objective to another. Crowson (2006) argues that most businesses become flexible primarily to reduce costs and thereby improve their competitive position in the market. However, the real objective of this investment is to be profitable by high volumes with reduced unit costs. The Solid Oxide Fuel Cell (SOFC) industry, because of its current low production quantities and low-rate production, has not been strongly influenced by high volume production concepts or automation requirements; although, automation can be justified for this industry due to precise and accurate product requirements.

Continuous Flow: The Most Adopted Solution for High Production Volumes

In 1913, Ford implemented the mass production concept, to assemble a vehicle that minimized the time that elapsed between beginning and completing production. The solution for Ford was to standardize huge volumes of products in a continuous flow and lower the in house inventory facility. Miltenburg (2005) claims that “a line flow system is appropriate when the product design is stable and the volume is high enough to make efficient use of a dedicated line.” Probably the second most important development in the manufacturing field was the link of the flow concept to Lean philosophy. Minoru M. President of Toyota Motor Manufacturing mentioned: “If some problem occurs in one-piece flow manufacturing then the whole production line stops. In this sense it is a very bad system of manufacturing. However when production stops everyone is forced to solve the problem immediately and so team members have to think, and through thinking, team members grow and become better team members and people”. In addition, not only will all the people be involved in the problem solution but the continuous process flow brings problems to the surface (Liker, 2004).

In addition, Stewart (2004) claims that companies generally try to settle into more stable ways of working such as fixed working patterns. For example, static product lines like the current Thermiculite 835 line have been a reference for product development at Flexitallic. Stewart (2004) suggests that the best companies make it easy to understand the organisation’s structure as well as its process/flow of work through the production systems. This argument suggests that these organizations are always clear and visible to employees for quicker track of difficulties. Finally, visual business processes allow everyone in the organisation, at all levels, to understand specific roles in the company and in what form their contribution has helped the company’s revenue.

To conclude, flow manufacturing is a concept that developed the process standardization in order to reduce total lead time and promote mass production success. After flow concepts were implemented in most of the industries, the systems needed to gain competitiveness through Lean practices. The Lean philosophy and Total Quality Management (TQM) provides waste elimination methods and continuous improvement techniques to the system. For this reason, Lean flow system provides employee engagement and total customer satisfaction. (Yumbla², 2011).

The Thermiculite 866 Project

Flexitallic Ltd designed Thermiculite 866 as a compression seal with high temperature resistance qualities for Solid Oxide Fuel Cells (SOFC), and other range of applications. Thermiculite 866 is based upon the use of extremely thin, flexible plates of the natural
Consumers and Communities (2017). Encouraging Participative Consumerism Through Evolutionary Digital Marketing: Emerging Research and Opportunities (pp. 54-94).
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