

INCREASING PRODUCTIVITY BY TOTAL QUALITY MANAGEMENT AND CONSTRAINT MANAGEMENT

Prof. Marius-Dan DALOTĂ, Ph.D.

Romanian-American University
1B, Expoziției Avenue, Sector 1, Bucharest
dalota.marius.dan@profesor.rau.ro

Abstract:

The paper argues that the total quality management concept and its implementation is the critical need for the survival of industries. In the meantime, lean manufacturing and constraint management could work together to improve productivity, efficiency and quality. The article discusses the environment in which businesses are operating, the effect of the total quality management on productivity and presents some of the benefits that were realized by implementing total quality management. Direct benefits from combining the concepts of lean manufacturing and constrained management during the productivity improvement process by using automation reduce production cycle times by more effectively designing and scheduling the movement of robots. The ultimate goal is to satisfy customers' demand. The paper discusses how constrained management substantially increases production.

Keywords: Productivity; Performance management; Total quality management; Constraint management; Lean production.

JEL Classification: M10

1. Introduction

Intense global competition and diminishing trade barriers are making it more and more difficult for companies to maintain their market share. Competition from companies operating in different markets has increased as advancements in telecommunications and information technology have broken down traditional barriers to entry.

In a competitive environment, a business must persuade a customer to buy its products rather than those of competitors at a price that is more than its cost of production. A rational customer, however, would like to maximize value for his money. Therefore, a successful producer must enhance the total value of his products so that the price is acceptable to the customer while his own costs are low enough to allow him to make a profit.

Total quality management (TQM) is all about fostering a culture that is continuously oriented towards increasing customer satisfaction while minimizing the real cost of production.

Increasing competition in the global market necessitates that productivity should not be considered as an indicator of efficiency only; it must also measure effectiveness. Yet the distinction between the two is often overlooked. For example, a company that produces according to process specifications may be using its resources efficiently, but unless it is producing what its customers want it may not be using them effectively. To be profitable, a company must judge productivity and value from the perspective of the customer, not from the engineer.

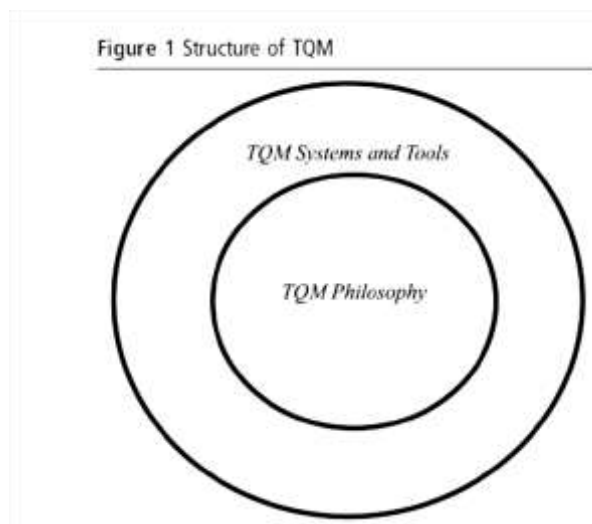
Older manufacturing facilities are often faced with productivity challenges due to their inflexible designs. The application of some of the principles of lean manufacturing is more restricted in such a setting. Today, “lean” may no longer be fashionable but its core principles (flow, value, pull, minimizing waste etc.) have become the paradigm for many manufacturing (and service) operations. In order to provide a platform for establishing the long-term competitive impact of the lean production model, the paper then develops a theoretical construct explaining the mechanisms that underpin sustainable competitive advantage.

2. Total Quality Management model and productivity

A simple model for TQM is depicted in **Figure 1**. The model consists of two main components:

- ♦ TQM philosophy;
- ♦ TQM systems and tools.

TQM cannot exist without a complete acceptance of its philosophy by at least the top management. Once the basic TQM philosophy is accepted by the top management then different systems and tools can be initiated to propagate and facilitate a culture based on such a philosophy.



TQM philosophy consists of four basic beliefs, which are as follows:

- ♦ absolute customer focus;

- ♦ employee empowerment, involvement and ownership;
- ♦ continuous improvement;
- ♦ the use of systematic approaches to management.

In 1984, Garvin has proposed the following five approaches to defining quality:

- ♦ *The transcendent approach is the philosophic concept of "innate excellence", which is both absolute and universally recognized through experience.*
- ♦ *The product-based approach focuses on the quantity of some ingredient or attribute possessed by a product. Like the amount of cream in ice cream, it can be assessed objectively and is based on more than preferences alone.*
- ♦ *The user-based approach begins with the premise that quality "lies in the eyes of the beholder". It is subjective and motivated and rooted in consumer preferences.*
- ♦ *The manufacturing-based approach focuses on engineering and manufacturing practices. It identifies quality as "conformance to requirements", and it is equated with meeting specifications or making a product right the first time.*
- ♦ *The value-based approach defines quality in terms of costs and prices. Quality provides performance at an acceptable price. The phrase "affordable excellence" summarizes the dilemma.*

2. This particular definition of quality is also presented in the pictorial form in Figure

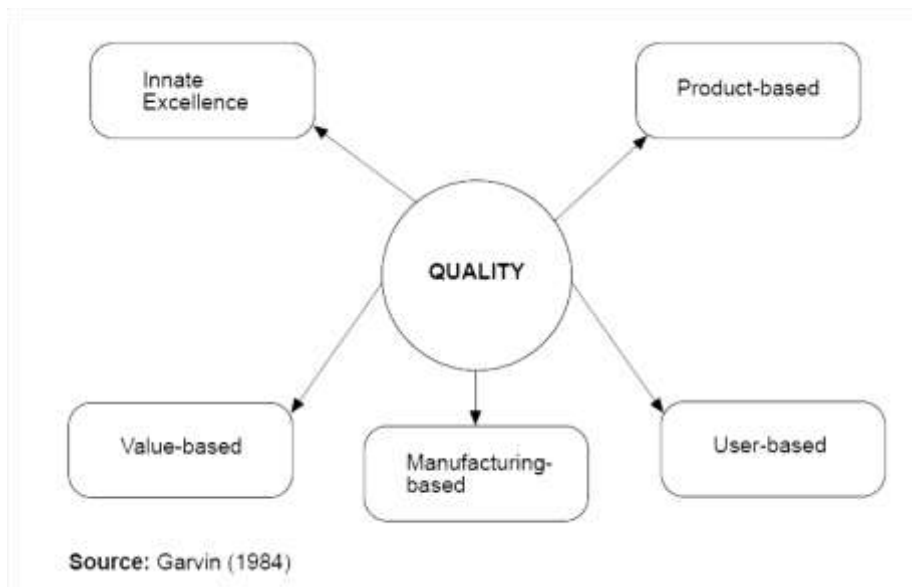


Fig. 2: Five approaches to defining quality

The TQM philosophy ensures “effective efficiency” by encouraging companies to plan products and develop systems that deliver products only according to the expectations of the customer. Companies that adopt TQM achieve greater effective productivity, profitability and market share for most kinds of products and market situations.

Delighted customers are the prime determinant of sustainable competitive advantage for any organization. To retain customers and entice new ones a company needs to focus on providing value to the customer and that too in a manner that is more effective than that of its competitors.

The ever-changing tastes of customers and pressure from competitors induce firms to adopt proactive strategies to retain and/or gain market share. Continuous improvement is essential for the very survival of a company. Both incremental and breakthrough improvements enhance productivity by decreasing costs and/or improving performance. Performance is enhanced through greater responsiveness, shorter cycle times for new products or services, better products, shorter throughput time and unique marketing, engineering or production strategies. Costs decline by reducing errors, defects and wastage.

Total Quality Management (TQM) improves the performance of organizations. The implementing an effective TQM would:

- ◆ *improve the profitability of the firm;*
- ◆ *increase revenues;*
- ◆ *reduce costs.*

We consider productivity enhancement as a process to achieve higher levels of output while consuming same or lesser amounts of input resources. If the same output level is reached in a shorter time period, it indicates improved productivity. It is in this respect, that projects designed to improve productivity must also consider time as a key resource.

Total quality management (TQM) is about leadership, planning and improvement and it is defined as “managing the entire organization so that it excels on all dimensions of products and services that are important to the customer”. An integral part of a TQM system is continuous improvement through a philosophy of product and process improvement as a never-ending journey. Increased levels of productivity result from improvement.

The possible critical factors that can cause the failure of productivity improvement programs are the following:

- ◆ *Lack of incentives or appropriate regards (or disincentives).*
- ◆ *Insufficient capital for improvement plant and equipment.*
- ◆ *Poor employee relations.*
- ◆ *Poor relationship with union leaders.*
- ◆ *Insufficient awareness by engineering of the manufacturing implications of product and process designs.*
- ◆ *Insufficient investment in workforce training.*
- ◆ *Poor financial controls and/or information systems.*
- ◆ *Weak middle managers.*
- ◆ *Decline of the work ethic.*
- ◆ *Weakness in industrial and manufacturing engineering.*
- ◆ *Weak first-line supervision.*
- ◆ *Poor communication organization-wide.*
- ◆ *A piecemeal, unplanned approach to improving productivity.*
- ◆ *Inadequate/ineffective coordination among departments or functional areas (excessive functional of departmental autonomy).*

- ◆ *Uncooperative union leadership.*
- ◆ *Poorly trained supervisory personnel in the area of productivity related problems.*
- ◆ *Programs that just cannot be implemented.*
- ◆ *Insufficient investment in management and supervisor training and development.*
- ◆ *Lukewarm commitment and involvement by top management.*
- ◆ *Lack of loyal, skilled workforce.*

A TQM program when properly implemented in an organization can direct the productivity projects towards achieving the competitive strategies of higher customer service and better quality in both product and process. It directs the objectives away from the conventional focus of cost cutting and directs the efforts toward efficient use of resources (materials, equipment, manpower, facilities). Given that TQM stresses continuous improvement, creativity and innovation are not lost. Therefore, a productivity improvement program that flows from a continuous improvement environment will emphasize creative ways of improving the use of resources.

The lack of top management support, coordination among functions, and organizational communications in combination with project planning, training and employee relationships, form a framework that discourage success in productivity projects at all levels of the organization. High productivity effects are impossible to sustain without a quality-based process-oriented environment which emanates from the support of employees, upper management, and the organization. This support comes first from an organizational atmosphere of quality excellence. The second component is a clearly communicated and well understood set of organizational performance goals focusing on the total organization. The management support flows from a cohesive organizational climate that promotes creativity and innovation through well trained employees. This may require a matrix type of project management approach to improving productivity.

The quality is the determinant of successful productivity improvements. The “fatal factors” of productivity improvement can be prevented by a pre-established quality program. A TQM program and its promotion of total employee involvement and commitment to continuous improvement is definitely a key to successful productivity improvement programs. Businesses facing complex productivity programs should establish a sound TQM program first, and then embark on the journey to improve productivity. If such an approach is adopted, the businesses will have minimal productivity problems.

3. Constraint management, Lean production and the competitive advantage relationships

Constraints management is a process of continuous improvement at the system level. It improves overall productivity by focusing efforts on improving operations at bottleneck resources.

Productivity is a measure of how effectively resources are used to produce various goods or services. Productivity is increased by producing more with the same amount of resources or by producing the same amount with fewer resources. Bottleneck is a resource that limits or constraints the capacity or maximum output of the process. If you

work on improving productivity on operations other than the bottlenecks, the only result you would get is frustration. The goal is to increase productivity by eliminating bottlenecks. We can't completely eliminate bottlenecks. When specialists eliminate one, and as the process speeds up in response, another operation or resource functions as a new bottleneck. The bottleneck reduces productivity and creates both blockage and starvation in the productive system. The blockage or excess inventory occurs at resources prior to the bottleneck, and the starvation occurs at operations after the bottleneck.

The constraint management views organization as a chain of dependent activities/functions and includes the following items:

- ♦ *Finding constraints and collecting data.*
- ♦ *Reducing volume losses.*
- ♦ *Reducing wastes.*
- ♦ *Having a clear goal.*
- ♦ *Reducing volume variation.*

The process is also represented in the flow chart in Figure 3.

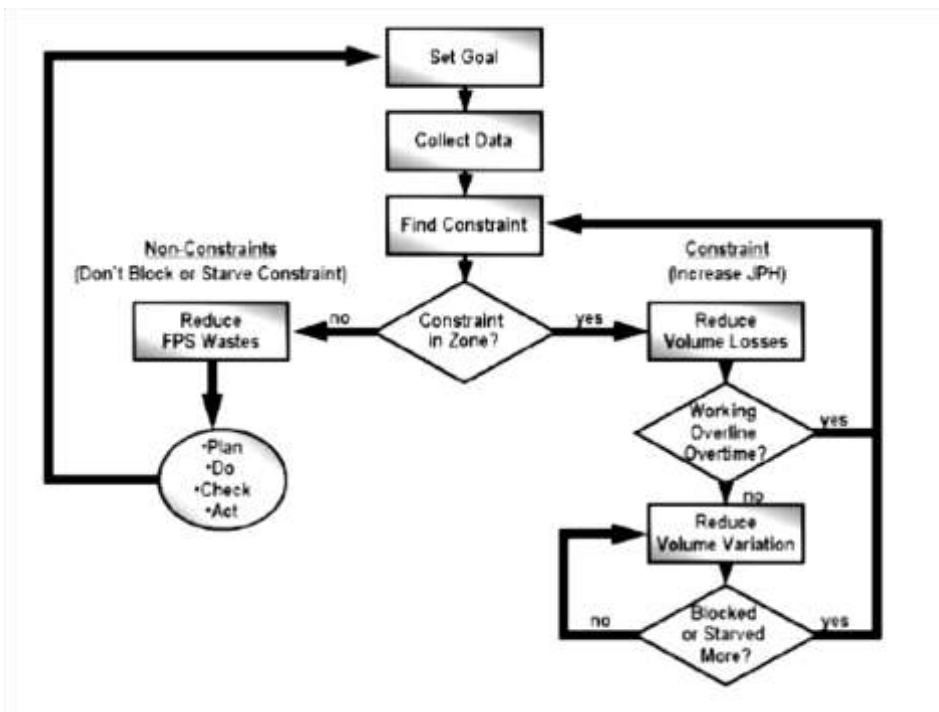


Fig. 3: Constraint management (Source: Shahram Taj, Lismar Berro, op.cit.)

The first step is to set the goal. The goal is to safely build the maximum number of good parts each hour, at minimum cost. Setting the goal involves the six steps below:

1. *Define the system.*
2. *Identify the system's constraint.*
3. *Decide how to exploit the system's constraint.*
4. *Subordinate everything else to the decisions made in Step 3.*
5. *Elevate the system's constraint.*

The term “lean manufacturing” or “lean production” were first used by Womack in 1990 in their historical book *The Machine That Changed the World*. The lean manufacturing describes the profound revolution that was initiated by the Toyota production system against mass production system.

Lean means “manufacturing without waste.” Waste is anything other than minimum amount of equipment, materials, parts, and working time that are absolutely essential to production. The lean approach is focused on systematically reducing waste in the value stream. The waste concept includes all possible defective work/activities, not only defective products. Waste can be classified in eight categories:

1. *Motion*: movement of people that does not add value.
2. *Waiting*: idle time created when material, information, people or equipment is not ready.
3. *Correction*: work that contains defects, errors, rework mistakes or lacks something necessary.
4. *Over-processing*: effort that adds no value from the customer's viewpoint.
5. *Over-production*: producing more than the customer needs right now.
6. *Transportation*: movement of product that does not add value.
7. *Inventory*: more materials, parts or products on hand than the customer needs.
8. *Knowledge*: people doing the work are not confident about the best way to perform tasks.

Most companies waste 70 percent-90 percent of their available resources. Even the best lean manufacturers probably waste 30 percent. Interestingly, every company has to find its own way to implement the lean method: there is no universal way that will apply to all. Despite the wide knowledge and available resources, many companies are struggling to stay “lean.”

Competitive advantage can be defined as the result of a business being either a particularly able player in its market (i.e. being better, which could mean being lower cost or more lean) and/or, being differentiated in what it offers. In order to build a useful construct to explain how competitive advantage is created and sustained, and in order to build directly upon the previous discussion of lean production, another input (resources), transformation (process) and outcome (competitive advantage) model will provide the basic structure of our discussions. Figure 2 presents this model in more detail, illustrating how resources are deployed in business processes to create competitive advantage.

Although both the lean production and sustainable competitive advantage models are illustrated using basic transformation representations there are some key distinctions between them. In exploring these distinctions we will develop the secondary set of research propositions that will guide the empirical work.

Sustainable competitive advantage, lean production and the competitive environment (Figure 4) illustrates how sustainable competitive advantage comes into being through the dynamic interplay between a firm and its external environment.

Certain resources can be strategic, but only if they cannot be copied or replaced by external rivals. Equally, firms need not directly own strategic resources (i.e. when developing manufacturing processes, resources that have competitive significance are often “owned” by suppliers). Similarly, all critical value creating processes stretch beyond the boundaries of the firm, involving actual and potential customers, and successful outcomes are only meaningful if they make the firm better and/or different.

Although the lean production model also stresses the generic importance of customers and suppliers, the attempt to create a series of "operating principles" has required advocates to downplay the significance of the interaction between specific internal and environmental contexts. It is important to relate all lean production/sustainable competitive advantage findings to the specific external context of the firm. The success of lean production in delivering sustainable competitive advantage will be contingent upon the external context of the firm (see P3).

Contextual factors might include: type of market (competitor activity, different demand profiles); dominant technology in sector; supply chain structure etc.

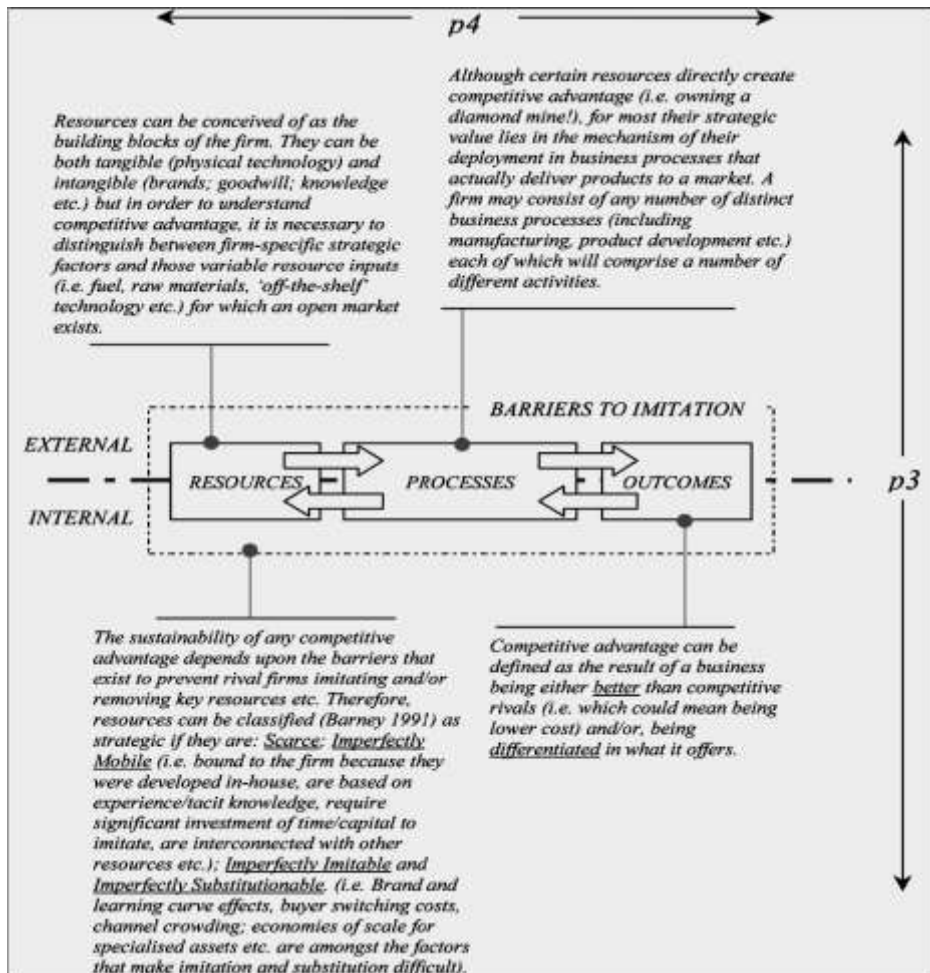


Fig. 4: Sustainable competitive advantage, lean production and the competitive environment relationships (Source: Michael A. Lewis, op.cit.)

The sustainable competitive advantage model argues that resources (skilled staff, market information, technological data etc.) create value when enacted in processes. In turn, these processes allow the organization to learn and thereby create new (or reinforce/extend existing) resources. When allied to the concepts of customer value stream and market pull, lean production suggests a very neat model of information and material flow. If the firm's competitive environment remains stable and modifies only slowly over time, then sustainable competitive advantage should be delivered through such adaptation. The final research proposition will explore the relationship between learning and lean production.

The more successfully any firm applies lean production principles, the less it will engage in general innovative activity (see P4). The firm will focus instead upon continuously improving existing processes and adopting incremental changes. Unfortunately, more and more markets are changing rapidly and the lean production view of continuous improvement might be trading short-term performance advantage for long-term viability.

Constrained management and lean manufacturing are complementary to each other, generating a great synergy when implemented together. They have played an essential role in improving productivity and competitive positioning in recent years. The first one is designed to improve system's throughput. The second methodology improves the manufacturing processes through the elimination of waste and continuous improvement. This requires a total cultural change towards lean thinking, identification and quantification of non-value and value added activities. The transformation requires everyone's participation and training.

While both initiatives are very effective, it is the clear understanding of their complementary interaction that fosters the synergy between them, avoids rework and ultimately gets both initiatives working in conjunction towards common objectives. Many companies have attempted one of these improvement strategies, some companies have tried both, but few have integrated the two practices into a single approach for achieving continual improvement. Managing constraints are extremely critical in a lean or cellular environment due to very small or no buffering in the process.

Constrained management has been traditionally applied in a batch and queue type operations, but not in a lean manufacturing environment. In a lean environment, all operations are running at the same takt time with no or very small buffering among them. This creates a very low margin for errors; therefore as soon as a resource becomes bottleneck, it immediately reduces the throughput.

4. Conclusions

Considering the current state of global competition, it is imperative for companies to develop a customer-focused culture as soon as possible. This would ensure that their resources are efficiently and effectively utilized to produce only those products and services which the customer wants and is willing to pay a premium price for.

Before any of this can be achieved, the management of organizations will have to fully understand and believe in the total quality philosophy without which achievement of maximum benefits would not be possible no matter how many material resources are

invested. The systems and tools cannot promise significant or sustainable results without the visible commitment of the top management to the TQM philosophy.

Looking at the experience of companies both local and international, which have implemented TQM successfully, there is little doubt that the Total Quality culture if applied correctly yields significantly better results in all the performance categories of financial results, customer satisfaction, and employee satisfaction. TQM also provides a long term sustainable competitive advantage in an increasingly competitive global market.

TQM is a paradigm shift from a reactive culture to a proactive one with the overriding emphasis on delighting the customer. Involvement and empowerment of every single employee within the organization - from the most humble to the most powerful is essential in order to develop ownership of the culture and to stem conflict of interest. As the scope is company wide, everyone is responsible for ensuring quality.

In this paper we also discussed how lean manufacturing and constraint management could work together to improve productivity, efficiency and quality. With the best practice guidelines being applied in manufacturing companies, the following benefits are possible:

- ♦ *Reducing production inventory and improve supplier performance: with pull-based tracking and replenishment.*
- ♦ *Increase yield and reduce scrap: by having operators use the most current work instructions, and ensuring they are cross-trained and certified.*
- ♦ *Enabling continuous process improvement: with a structured approach to identifying, tracking, resolving, and measuring issues and incidents.*
- ♦ *Speeding decision making and problem resolution: with real-time process control, analytics and event management.*
- ♦ *Driving business change through metrics: to measure and eliminate non-value-add, and to validate continuous process improvements.*

It is important that lean improvement principles and tools that focus on waste elimination and process speed; constrained management that focuses on increasing throughput, plus a financial screening rigor for projects; and productivity improvement in the organization's cultural focus and creation of accountability, energy, and ownership through a new structure and set of principles. The ultimate goal is to satisfy customer demand.

Bibliography:

- [1.] Dalotă Marius-Dan, "*Small and medium enterprise's growth and new technologies implementation*", *Romanian Economic and Business Review*, Vol.7, no.2, 2011
- [2.] Khan Jamshed H., "*Impact of total quality management on productivity*", *The TQM Magazine*, Volume 15 Number 6, 2003 pp. 374-380
- [3.] Juran, J.M. "*Juran's New Quality Roadmap*", Free Press, New York, 1988
- [4.] Hoffman Joyce M., Mehra Satish, "*Operationalizing productivity improvement programs through total quality management*", *International Journal of Quality & Reliability Management*, Volume 16 Number 1 1999 pp. 72-84

[5.] Gunasekaran A., Goyal S. K., Martikainen T., Yli-Olli P., “*Total quality management: a new perspective for improving quality and productivity*”, International Journal of Quality & Reliability Management, Vol. 15 No. 8/9, 1998, pp. 947-968.

[6.] Taj Shahram, Berro Lismar, “*Application of constrained management and lean manufacturing in developing best practices for productivity improvement in an auto-assembly plant*”, International Journal of Productivity and Performance Management, Vol. 55 No. 3/4, 2006, pp. 332-345

[7.] Womack, J., Jones, D. Ross, D., “*The Machine that Changed the World*”, Edit. Rawson Associates, New York, 1990

[8.] Michael A. Lewis, “*Lean production and sustainable competitive advantage*”, International Journal of Operations & Production Management, Vol. 20 No. 8, 2000, pp. 959-978