THE LEANNESS MEASUREMENT ESSAYS IN THE LOGISTICS LITERATURE

Bülent Sezen¹, Sema Erdoğan² and İbrahim Sarper Karakadılar³

Abstract — The term “lean” is firstly coined in the literature by Krafcik to describe the Toyota production system, then has been started to study as a familiar subject in the beginning of the 90’s after Womack, Jones and Roos published the distinguished book about the automobile industry.

In previous researches there are several supply chain performance measurement instruments; on the other hand there are only a few improvements specifically about the lean supply chain scale. In the 90’s and 2000’s the studies about lean production or leanness are mostly examined on the work processes and implementations in the manufacturing firms. The degree of the leanness of a firm or measuring the lean principles’ outputs has not widely examined.

The purpose of our research is to introduce a literature review about “the lean production and the leanness measurement approach” and their findings to support our perspective. These kind of conceptually lean framework studies can investigate an empirically leanness model, because unfortunately the literature hasn’t yet witnessed a most-widely accepted model about leanness. We consider all possibilities in many manufacturing industries other than automobile industry, so the lean production system or philosophy can also be implemented to the other industries as well as services sector. An empirically validated and a reliable leanness measure model need to be introduced fit to several areas.

Keywords —Leanness, Lean Logistics, Leanness Measurement, Literature review.

INTRODUCTION

The term “lean” is firstly coined in the literature by Krafcik [1] to describe the Toyota production system, then has been started to study as a familiar subject in the beginning of the 90’s after Womack, Jones and Roos [2] published the distinguished book about the automobile industry. Since that time the leanness has been studied conceptually and empirically, mostly focused on the automobile industry and based on a few different industries. As examples, ceramics industry [3], electronics, telecommunication, wireless, computer, pharmaceutical, petroleum [4], etc. In these researches the lean has been conceptualized and defined from different point of views.

Our study of lean basically includes two perspectives: 1) working processes and 2) managerial issues. Working processes means the perception and the way of doing work of the employers in the lean enterprises. The managerial approach of the lean can be a strategy or a philosophy.

The lean approach offer firstly elimination of waste which is non value adding. This approach leads to improvements and obtain quality standards in the set of practices or techniques. It provides the multi-skilled

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employers who are able to work efficiently in the lean enterprises. Thus, lean enterprises focus on their core businesses with the principle of the right time and the minimum cost. As a result, it brings the excellence.

In this study the authors aim to introduce firstly a literature review about the lean production, and than in the later sections the principles of the lean production and the meaning of the measurement of leanness will be discussed given with a table of the previous studies. In the conclusion part, we sum up all the measurement essays to display a new and validated scale.

LITERATURE REVIEW

Today, several members of lean community want to know how to evaluate the lean efforts of their company: “How do we know how lean we are?” or “What metrics should we use to measure our progress?”, etc. [5]. As Womack defined, business purpose always has two aspects – what you need to do better to satisfy your customers and what you need to do better to survive and prosper as a business.

The term ‘lean’ embodies a system that uses less of all inputs to create outputs similar to the mass production system but offering an increased choice to the end customer. The logic behind lean thinking is that companies jointly identify the value stream for each product from concept to consumption and optimize this value stream regardless of traditional functional or corporate boundaries [6].

So in term of “lean production”, this system enables the firms can do more with less. Especially in 90s up to 2000s, much of the analysis on lean production focused mainly on the automotive industry [6]. But in the 2000s the practitioners has examined also its impacts on the other industries. To measure the leanness level of a company, the studies started to introduce some scale instruments according to the lean principles, too, which was determined by Womack and Jones in the book named “Lean Thinking” published in 1996 [7].

The determined (by Womack and Jones) five main organizing principles for creating a lean production system are (1) specify value by product, (2) identify the value stream for each product, (3) make value flow without interruptions, (4) let the customer pull value from the producer, and (5) pursue perfection [8]. So, these principles are used with some tools in the value chain and the mentioned lean tools are JIT, KANBAN, Kaizen, TPM, 5S, etc.; that are the techniques for eliminating waste, improving quality, getting customers’ needs and reducing the costs. Numerous tools and techniques have been developed to tackle specific problems in order to eliminate non-value-added activities and become lean [9].

On implementations, the studies in the literature have focused on these lean tools to measure the lean production system’s effect in the firms or industries. This effect is called “leanness” level of a firm in many articles [3], [9], [10], [11]. So we also use this term to define the lean production effect, in other words “a leanness measure shows ‘how lean’ the system is” [9].

LEANNESS MEASUREMENT ESSAYS IN THE LITERATURE

In the previous researches; in every essay, which tries to establish a leanness measure, it is pointed out the lack of an objective and valid scale in the literature about lean production. As examples: “…An objective, quantitative, and integrated measure of overall leanness has not been established for lean practitioners to measure how lean a system is” [9]; “…no study has developed a systematic and relative measure of lean production systems” [10]; “Despite variable evidence regarding performance improvements related to these lean practices, relatively little empirical research exists to gauge the extent of performance improvements” [12], etc.

There are two major articles we found about lean measurement to introduce valid scales; one of them is Shah and Ward’s study published in 2007. Shah and Ward [13] developed a measure for lean manufacturing and characterize 10 dimensions according to the lean tools: Supplier feedback, JIT delivery by suppliers, supplier development, customer involvement, pull system, continuous flow, set up time reduction, total
productive/preventive maintenance, statistical process control and employee involvement. All of these dimensions are related to the operational perspective of the lean production system.

Another leanness scale was developed by Li et al. in year 2005. Li et al. [14] measured lean production internally in firms with five items: Set up time reduction, continuous improvement, pull system, lead-times reduction and supplier involvement. These dimensions are also related to the operational perspective of lean production system.

There are also some improvements on developing measurements about leanness in the logistics literature. The mentioned dimensions are: cost, time and product value [9]; elimination of waste, continuous improvement, zero defects, JIT deliveries, pull of raw materials, multifunctional teams, decentralization, integration of functions, vertical information systems [3]; stockholding levels, set-up time reduction, in-plant usage of KANBAN and cellular layout [15]. In Table 1 we prepared an extensive review of the lean measurement dimensions.

The dimensions in these studies are inspired always from the lean principles and tools; that’s why the questionnaires of these scales are mostly operational level in the firms. The managerial approach to answer the lean effects may be the “value stream”, “cost reduction” or “philosophy” types of questions.

Meanwhile there is also an important thing, that the examined firm in which level of its leanness is measured, it means the leanness level can differ firm by firm. The leanness score represents the leanness level of a system [9].

**FINDINGS**

Our approach to develop a leanness measure is from two points of view; 1) from a philosophical perspective, and 2) from the practical perspective [13]. That’s why we intend to choose the dimensions to develop a scale fit to these two perspectives. Our dimensions are:

*Value added work
*Quality
*Continuous improvement
*Problem Solving.

**Value added work:** On the shop-floor there is great deal of time spent in the operation processes and most of work is non-value-added, like waiting time on machines or parts, non-value added activities of employees or large number of equipments. In lean organizations the managers, directors, operators and employers aim to develop new work methods to eliminate non-value-added steps. When we can look into the processes, we may measure the percent of value-added works, if there is an improvement.

**Quality:** The lean production principles bring excellence not only eliminating waste or steps but also by improving the customer needs and quality. A lean organization tends to use preventive quality tools, like FMEA (Failure Mode Effects Analysis) or driving zero defects.

**Continuous improvement:** It is the conviction that improvement efforts are never finished, and it is the consistency to keep the discipline for improvement in place (kaizen) [16]. It is a “way of life”.

**Problem solving:** In a lean organization, problem solving methods are standardized, and operators are trained on their use. All problems are investigated using a “team”, structured problem solving approach.
Lean Dimensions (more philosophy)

- Value-added work
- Quality
- Continuous improvement
- Problem solving

Lean Tools (more process)

- Kaizen, TPM, Kanban, Waste elimination, JIT, 5S, Pull system, etc.

These four dimensions can bring more philosophical tendency to lean production system’s effect (or outputs), which brings excellence through creating value in lean supply chains. On the other hand, up today all studies have examined the practical and operational (working processes) side of the lean production that develops a measure. As an example, pull system, KANBAN or JIT delivery can be the operational tools of lean system [3], [4], [13], [15], [16], [17], [18]; but principles, like “value creating” or “problem solving” are core of the meaning of the lean production [9]. In competitive and increasingly global industries [6], measurable benefits are competitive advantages in applying the lean principles.

CONCLUSION

Before measuring the leanness level of a firm, first of all we must start with business need with customer and company [5], and the second step is about people, if the employees touch the value stream effectively, or not. Womack’s [5] formula for evaluating the lean efforts is very simple: “Examine your purpose, then your process, then your people.” Only after the companies can understand their real purposes and find out the gap in the processes for which the lean tools can be implemented, than we can ask firms “how lean they are”.

We intend to develop a leanness measure to evaluate the firms’ lean efforts’ outputs and choose 4 dimensions: 1) value added work, 2) quality, 3) continuous improvement and 4) problem solving. They cover many of tools of lean production system and are more philosophically. For example, value-added work covers a lot of lean techniques to eliminate waste: e.g. set-up time reduction, employee involvement and multi functional teams. In addition to categorize the leanness measures into four main dimensions we also scattered the tools and techniques into the groups so that the upper management can understand the philosophy of lean more easily (Figure 1).

These dimensions may summarize the concepts of leanness and explain how they can be applied to create a lean supply chain. Our findings from the literature review of lean related studies reveal that the scale items used by the researchers are mostly focusing on operational perspective. The next step in the future studies might be directed to combine this operational perspective with a broader managerial context so that the measurement scales of leanness become useful not only for manufacturing companies or automotive industry, but for every kind of business.
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REFERENCES


Leanness definition, (of persons or animals) without much flesh or fat; not plump or fat; thin: lean cattle. See more. The lean part of anything. Typesetting. matter that is difficult to set because of complexity or intermixed fonts. Compare fat (def 23). See more. See less.

Related content. The Google Effect And More â€” Rulesâ€™ The Internet Created Who needs to stash away names and dates into our longterm memory when we have Google? And, guess what, that phenomenon has a name! READ MORE. Traditionally, inventory leanness has been measured using inventory turns, which in simple terms can be expressed as the ratio of sales to the average inventory level. The inventory turns measure was easy to compute, easy to explain, and easy to use, so it was widely adopted and many variants were developed. Yet the basic idea has never changed: simply compare inventory levels to sales. In the beginning, Firm B was below the turnover curve, indicating that its inventory was lean. After its sales and inventories doubled, it moved above the curve, because it has not experienced the efficiency gains that would be expected as a result of increased sales. Nevertheless, inventory turns suggest that Firm B is still as efficient as before.