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No Lean Without Learning: Rethinking Lean Production as a Learning System

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Abstract. It's one of the most popular and most misunderstood business concepts of our time. Since the term Lean Production was first popularized in 1990, lean has come to mean very different things to different people. In this paper, we go back to the origins of Lean Production - an alternative business approach pioneered by Toyota Motor Corporation - and present insights into how Toyota actually developed a learning system to gain competitive advantage through the continuous development of people, rather than simply designing and optimizing an efficient production system. We draw on our observations from Toyota plants around the world and our discussions with various Toyota sensei, and present a framework for understanding lean as a learning system, *not* a production system.

Keywords: Lean Production, Toyota Production System, Total Quality Management.

1 Introduction

Lean Production has a research history spanning over 30 years. Yet, it is still a puzzle why some companies and CEOs who adopt Lean Productions tools and principles experience extraordinary business results, while others experience little or no improvement, at best exhibiting only marginal gains in operational performance.

In *the Machine that changed the World* [1] the authors present Lean Production as a complete business system, consisting of five parts: Dealing with the customer, Designing the car, Running the factory, Coordinating the supply chain, and Managing the (lean) enterprise. Yet, Lean Production is still mostly associated with efficient production and operational excellence. Because the systematic learning practices of Toyota consist of tools and principles, it becomes easy for companies and CEOs who operate in the business paradigm of design-execute-optimize to turn these tools and principles into one-time improvements to their production system by interpreting Lean Production simply as a set of best practices that can be implemented to achieve operational excellence.

There are many different paths to new value creation, to realize products and services that will create value for both the customer and the producer. For example, one can introduce a product or service that is radically different to what has ever been offered before, and then optimize the delivery process for that particular product or service until defunct. On the other hand, it is possible to incrementally change an existing product to deliver more functionality at lower cost. Often, Lean is thought of as simply a method for optimizing flow in the design, manufacturing and delivery process, and has even been critiqued as a hinderance of innovation [2].

In this paper we present Lean as a different paradigm, based on the assumption that Toyota asked themselves a different question from the outset. Instead of asking; “*how do we optimize the design, manufacture and delivery of our products?*”, they asked themselves; “*how can we create, manufacture and deliver ever better products by learning and evolving from one change to another, always looking for the next step?*” [3] This paper identifies four separate learning systems that each serve a different purpose. The basic questions underpinning these systems are: How to create a constantly evolving product line? What to keep and what to change when developing new products? How to constantly and consistently look for the next step? And how to make the managerial organization change its response as the company evolves?

2 Literature Review

After over 40 years of research into the operational and managerial practice of Toyota and 30 years of research on Lean Production there is an abundance of literature that presents these practices [cf. 3], the adoption of such practices into different companies or different industries [5, 6], how to implement these practices [7–9], what to expect from adopting them [10, 11], and how these practices influence worker conditions [12, 13].

The research that has studied Lean Production and learning simultaneously has usually focused on the evolving understanding of Lean Production. For example, [14] describes the evolution of the understanding of Lean Production, concluding that a separation of the strategic and operational aspects of lean is needed. Another example is [15] which discusses the history of the International Motor Vehicle Program (IMVP) that gave rise to the term Lean Production, highlighting the key events of the development of car production and the major publications that chronicled them.

There is also a body of research on organisational learning in general [cf. 16]. Some of this research was based on case studies of Japanese companies in the quality management tradition [17]. However, this body of research has not explicitly looked at the practices of Toyota as a system of organisational learning per se.

Fujimoto, one of the first researchers who studied lean as a learning system [18] described the evolutionary learning capabilities of the Toyota Production System, and how they built on the practices of American automakers and from their experiences with producing automatic looms. Toyota further developed a system that enhanced the

learning capabilities of its people through smaller lot sizes, and the experimentation needed to develop in-house design and production capabilities [19].

By looking at Lean as a *learning* paradigm, the tools and techniques can be seen as accelerators for learning rather than as a means for achieving operational excellence, showing where and what we need to improve [20]. The improvements are realized by the people working in the system, not by the tools themselves. In fact, Some Toyota veterans refer to TPS as the *Thinking People System* - a system for continuously developing people through problem solving [21] placing greater emphasis on the suggestion that “*Toyota makes people before they make products*” [22].

Toyota’s practices are both “hard”, allowing the company to constantly develop its technical know-how in design and manufacturing, and “soft”; an organisation open for criticism, where there is enthusiasm for improvements and a focus on developing employees [23]. These practices create a learning environment for self-testing and adoption [24] where the emphasis is not on process efficiency, but instead on developing the technical and creative skillsets of the company’s workers and managers – skillsets that are critical for sustained innovation [25]. The emphasis on learning is what drives innovation in both design, engineering and manufacturing, and what allows Toyota to align the organisation by engaging “*all the people, all the time, everywhere*” [26].

3 Research Design

This is a conceptual paper based on an exploratory investigation of Toyota Motor Corporation (TMC), drawing new insights from the observations of the authors during site visits, from the available literature that describes Toyota’s business practices, and from semi-structured interviews with current and former company employees from various functions in the organization – including product planning, product development, production and quality management. In addition, we draw on our practical experience with lean implementations in various industries and companies worldwide.

4 Lean as a Learning System with Four Distinct Sub-systems

Through our research (as a process of discovery), we have gradually come to recognize lean as a learning system. In this process of discovery, four distinct sub-systems emerged, each serving a different purpose:

- Product Planning (PP) system – how can we learn what products to improve or introduce next to make each customer a life-time customer?
- Toyota Product Development System (TPDS) – how do we keep in touch with customers evolving needs and better understand what to keep and what to develop or discard in each product?
- Toyota Production System (TPS) – How can we continuously look for the next step?

- Total Quality Management (TQM) – How do we develop the management and back-office practices that are needed to support the other three learning systems?

The Lean Product Planning system has more recently been exemplified by Apple, a company that, as if by clockwork, introduces new products each year in September. Some products will go through a full update of specifications and features, while others will have smaller, sometimes cosmetic changes made to them. Ever since Toyota and the other Japanese car companies decided to compete in all segments, as opposed to dividing the different market segments between them, Toyota has constantly sought to learn how to make a *first-time customer a life-time customer*; whereas other companies have sought to be efficient in their use of capital and assets by constantly looking to shed older products and / or move away from unprofitable market segments. Toyota has constantly evolved its range of products, while efficiency of capital and assets are driven by Value Analysis and Value Engineering (VAVE), a fundamental part of the Target Cost planning system [27]. **The core learning challenge for the Product Planning system is how to constantly evolve the product line-up such as to never lose a customer.**

When Toyota set out to design and develop its own automobiles, they did not start by licensing American or European models. Instead, they set out to learn how to design automobiles from scratch. Exemplified by the 12 generations of Corollas designed and manufactured for almost 60 years, the Toyota Product Development System (TPDS) builds on generations of acquired engineering know-how that is recorded and kept in the form of A3 reports and concrete technological learning curves [26]. **The core learning challenge for this system is to discover what to keep and what to change** (Approx. 70% of an existing product remains untouched in the next version [27]).

Instead of creating a production system from scratch, Toyota set out to create a revolutionary learning production system that built on the industrial engineering breakthroughs of Ford, GM [18], and German aircraft manufacturers [15]. However, instead of just adopting best practices, we believe that Toyota developed its production system practices by continuously looking for the next step. First, by mechanically connecting each process with its direct customer through Just-in-time and the Kanban system in order to foster continuous improvement through respect for people and full worker participation [28]. Second, by reducing changeover time in order to reduce batch sizes and reduce the lead-time between order and delivery on each internal Kanban; and third, by creating a system of visual control (Andon) to stop and fix defects at the point of discovery [29]. Indeed, from our discussions with current and previous Toyota employees, we understand **the core learning challenge of this system is satisfying the conditions of basic stability, just-in-time, jidoka, and employee satisfaction by encouraging the constant search for the next step of lead-time reduction, flexibility-enhancement, cost-reduction and quality-improvement, made possible by the continuous development of all employees, at all levels. This will lead to higher customer satisfaction.**

Finally, after discovering that the rate of quality improvement did not keep up with the rate of productivity improvements, Toyota accepted the challenge from Ishikawa and Deming to build quality into the product at the design stage, by creating a system of quality assurance, rather than inspecting poor quality out of the system after production [30]. This Total Quality Management (TQM) system evolved from the early 1960s into “The Toyota Way” [3] and represents the fourth learning system. **The core learning challenge of this system is how to support the development of zero defect thinking amongst managers and back office staff – in addition to front line associates.**

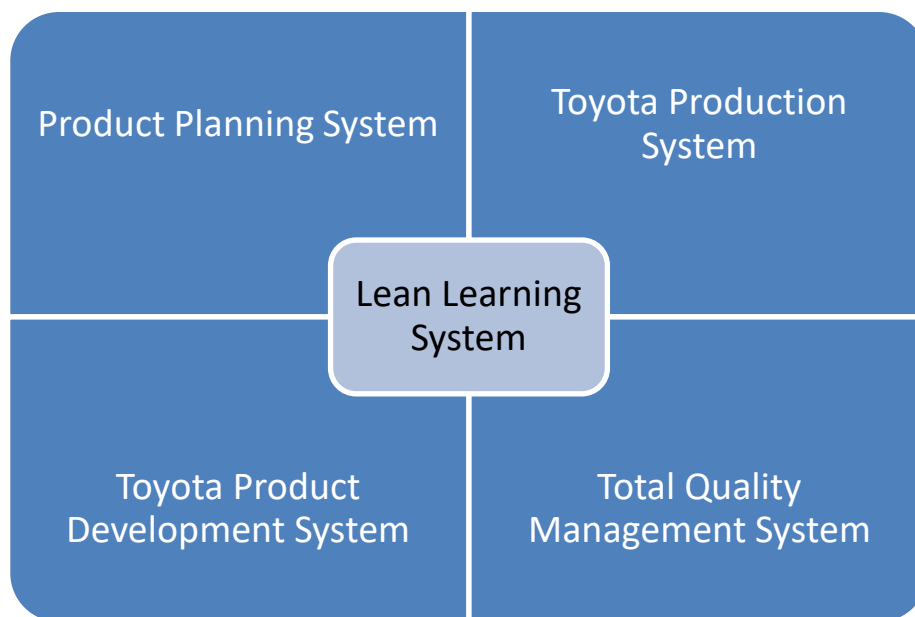


Figure 1: Lean Learning System: Four Distinct Sub-systems

5 Conclusions

Based on the findings, we are able to reframe Lean Production as a learning system, consisting of four distinct sub-systems (see Fig. 1). The sub-systems are by no means discrete but are profoundly integrated and intertwined throughout the organization as an organic entity. The learning sub-systems described herein consist of both principles and tools that aim to deepen thinking and experimentation. Understanding and adopting both is critical to the success of the *lean enterprise*. Ignoring the principles and simply copying the tools and adopting them as best practices often leads to unsatisfactory results and discontinued lean implementations, yielding little learning and at best offering only point optimization. The learning system as presented in this paper represents the findings from looking at Toyota’s principles and practices together from the lens of a learning paradigm. With the continuous development of people at its core,

such a learning system promises to build improved organizational capabilities through a resolute process of continuous experimentation and learning.

We suggest that this article has implications for both theory and practice. Firstly, with regard to theory, we reframe Lean Production as a learning system, by drawing on insights from Toyota Motor Co. as the de facto exemplar of the *Lean Learning System*. This promises to help academic researchers to understand the real reasons for the success of Toyota - a company that exhibits the sales volumes of Volkswagen combined with the 'boutique' profitability of BMW.

Secondly, for practice, we suggest that by rethinking Lean Production as a learning system to continuously develop people (throughout the entire enterprise not just factory floor operations) through promoting structured problem solving and improvement using deep thinking, reflection and experimentation, organizations may be better prepared to realize the true potential of a successful lean transformation, reducing the otherwise high rate of failure reported for so-called "lean implementations". This is achieved in practice by actively discovering what one needs to learn to solve the next problem, rather than simply planning to implement the next *best practice* from the lean *toolbox*.

Understanding that lean is *not* a production system but rather a system for continuous improvement and learning is essential for business success in the future. After all, improvement without learning is not lean thinking [31].

References

1. Womack JP, Jones DT, Roos D (1990) The machine that changed the world, 1st ed. Simon & Schuster
2. Benner MJ, Tushman ML (2003) Exploitation, Exploration, and Process Management: The Productivity Dilemma Revisited. *Acad Manag Rev* 28:238–256. <https://doi.org/10.5465/amr.2003.9416096>
3. Toyota Motor Corporation The Toyota Production System. Oper. Manag. Consult. Div.
4. Monden Y (1983) toyota production system: practical approach to production management. Productivity Press, Portland
5. Andersen B, Belay AM, Seim EA (2012) Lean construction practices and its Effects : A case study at St Olav ' s integrated Hospital , Norway. *Lean Constr J* 122–149
6. Andersen H, Røvik KA (2015) Lost in translation: A case-study of the travel of lean thinking in a hospital. *BMC Health Serv Res* 15:1–9. <https://doi.org/10.1186/s12913-015-1081-z>
7. Achanga P, Shehab E, Roy R, Nelder G (2006) Critical success factors for lean implementation within SMEs. *J Manuf Technol Manag* 17:460–471. <https://doi.org/10.1108/17410380610662889>

8. Netland TH (2015) Critical Success Factors for Implementing Lean Production: The Effect of Contingencies. *Int J Prod Res.* <https://doi.org/10.1080/00207543.2015.1096976>
9. Bhasin S (2012) Prominent obstacles to lean. *Int J Product Perform Manag* 61:403–425. <https://doi.org/10.1108/17410401211212661>
10. Netland TH, Ferdows K (2014) What to Expect From a Corporate Lean Program. *MIT Sloan Manag Rev Summer*:83–89
11. Karlsson C, Åhlström P (1996) Assessing changes towards lean production. *Int J Oper Prod Manag* 16:24–41
12. Huxley C (2015) Three Decades of Lean Production: Practice, Ideology, and Resistance. *Int J Sociol* 45:133–151. <https://doi.org/10.1080/00207659.2015.1061859>
13. Hasle P, Bojesen A, Langaa Jensen P, Bramming P (2012) Lean and the working environment: a review of the literature. *Int J Oper Prod Manag* 32:829–849. <https://doi.org/10.1108/01443571211250103>
14. Hines P, Holweg M, Rich N (2004) Learning to evolve - A review of contemporary lean thinking. *Int J Oper Prod Manag* 24:994–1010. <https://doi.org/10.4324/9781315857817-11>
15. Holweg M (2007) The genealogy of lean production Matthias. *J Oper Manag* 25:420–437. <https://doi.org/10.1016/j.jom.2006.04.001>
16. Senge PM (2006) *The Fifth Discipline: The Art and Practice of the Learning Organization*, 2nd ed. Random House Inc
17. Nonaka I (1991) Knowledge Creating Company. *Harv Bus Rev* 96–104
18. Fujimoto T (1999) *The Evolution of a Manufacturing System at Toyota*. Oxford University Press, New York
19. Cusumano M a (1988) Manufacturing Innovation: Lessons From The Japanese Auto Industry. *Sloan Manage Rev* 30:29
20. Ballé M, Chaize J, Fiancette F, Prévot E (2010) The Lean Leap: Lean as a Learning Accelerator. *Reflections* 10:1–17
21. Balle M, Beaufallet G, Smalley A, Sobek DK (2006) The Thinking production system. *SoL J Knowledge, Learn Chang* 7:
22. Alves AC, Dinis-Carvalho J, Sousa RM (2012) Lean production as promoter of thinkers to achieve companies' agility. *Learn Organ* 19:219–237. <https://doi.org/10.1108/09696471211219930>
23. Osono E, Shimizu N, Takeuchi H (2008) The contradictions that drive toyota ' s success. *Harv Bus Rev* 98–104
24. van Driel H, Dolfsma W (2009) Path dependence, initial conditions, and routines in organizations - The Toyota production system re-examined. *J Organ Chang Manag* 22:49–72. <https://doi.org/10.1108/09534810910933906>
25. Ballé M, Morgan J, Sobek DK (2016) Why Learning Is Central to Sustained Innovation. *MIT Sloan Manag Rev* 57:63–71
26. Morgan J, Liker JK (2019) *Designing the Future*, 1st ed. McGraw-Hill, New York
27. Hino S (2006) *Inside the Mind of Toyota*, 1st ed. Productivity Press, New York
28. Sugimori Y, Kusunoki K, Cho F, Uchikawa S (1977) *Toyota production system*

and kanban system materialization of just-in-time and respect-for-human system. *Int J Prod Res* 15:553–564. <https://doi.org/10.1080/00207547708943149>

29. Ohno T (1978) *Toyota Production System: Beyond Large-Scale Production*. Product Press 1:152. <https://doi.org/10.1108/eb054703>
30. Ishikawa K (1985) *What is Total Quality Control?: The Japanese Way*. Prentice-Hall, Engelwood Cliffs N.J.
31. H. Netland T, Powell D (2017) *The Routledge Companion to Lean Management*. Routledge