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LEAN/AGILE/6 SIGMA AND HRM

1. ABSTRACT

In this paper it is provided the overview and comparison of different philosophies, methodologies or tools that are used in companies for improving the business performance. Furthermore it is given and input about the nature of core business (manufacturing vs IT) and its' compliance for implementation of a specific philosophy, methodology or tools. It is used an exploratory design since it provides an opportunity to clarify existing concepts. At last, it is given a conclusion about the importance of HRM in supporting the business, where specifically is determined why HRM has an important role in implementing and sustain a Lean, Agile and/or 6 sigma practices.

Keywords: Lean, Agile, 6 sigma, HRM

2. INTRODUCTION

In this paper the focus is on different management approaches concerning the business performance and the improvements and sustainability. Specifically it's presented the concept of Lean, Kaizen, 6 sigma and its interference, variations and modifications. Moreover, it will be pointed how HRM is complementary to the respected approaches, practices and or tools.

3. LEAN

Lean management is an easy-to-understand, suitable, methodology to drive continuous and systematic improvement within an organization

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with the implication of all personnel.² Lean is a continuous process improvement methodology consisting of five primary principles:³

- Value (from the customer's perspective)
- Value Stream (map the steps in the value stream)
- Flow (create a smooth flow)
- Pull (the right amount pulled at the right time, no more, no less)
- Perfection (elimination of all waste in the value stream)

As far as Lean methodology is concerned, the only way to determine if something has value or not is to consider whether a customer would be willing to pay for it.⁴ Operations that fail to create value for the end customer are deemed “wasteful.”⁵ Therefore we describe the abbreviation of TIMWOODS that stands for reducing waste in:⁶

T – Transport – Moving people, products & information

I – Inventory – Storing parts, pieces, documentation ahead of requirements

M – Motion – Bending, turning, reaching, lifting

W – Waiting – For parts, information, instructions, equipment

² López-Fresno P., Contribution of Lean Management to Excellence, Nang Yan Business Journal – 1.1 – 2012 Paper #: 2 – 03, https://www.researchgate.net/publication/286909847_Contribution_of_Lean_Management_to_Excellence/fulltext/566f20cc08aedcd2356182a/286909847_Contribution_of_Lean_Management_to_Excellence.pdf?origin=publication_detail, Page 96,

³ Lean Manufacturing, LeanConsultingWorks, LLC, <http://www.leanconsultingworks.com/lean-manufacturing.htm>, date 02.03.2018

⁴ Gupta D, Success Using Lean Six Sigma in Terms of Operations and Business Processes, [https://books.google.mk/books?id=aQXeBgAAQBAJ&pg=PA19&lpg=PA19&dq=As+far+as+Lean+methodology+is+concerned,+the+only+way+to+determine+if+something+has+value+or+not+is+to+consider+whether+a+customer+would+be+willing+to+pay+for+it&source=bl&ots=bPSwNW6XMw&sig=5ze7Si2qsTmtwPBwzQW64-](https://books.google.mk/books?id=aQXeBgAAQBAJ&pg=PA19&lpg=PA19&dq=As+far+as+Lean+methodology+is+concerned,+the+only+way+to+determine+if+something+has+value+or+not+is+to+consider+whether+a+customer+would+be+willing+to+pay+for+it&source=bl&ots=bPSwNW6XMw&sig=5ze7Si2qsTmtwPBwzQW64-5Zvs4&hl=en&sa=X&ved=0ahUKEwit2svy583ZAhUBfFAKHwDgAvoQ6AEIOjAC#v=onepage&q=As%20far%20as%20Lean%20methodology%20is%20concerned%20C%20the%20only%20way%20to%20determine%20if%20something%20has%20value%20or%20not%20is%20to%20consider%20whether%20a%20customer%20would%20be%20willing%20to%20pay%20for%20it&f=false)

[5Zvs4&hl=en&sa=X&ved=0ahUKEwit2svy583ZAhUBfFAKHwDgAvoQ6AEIOjAC#v=onepage&q=As%20far%20as%20Lean%20methodology%20is%20concerned%20C%20the%20only%20way%20to%20determine%20if%20something%20has%20value%20or%20not%20is%20to%20consider%20whether%20a%20customer%20would%20be%20willing%20to%20pay%20for%20it&f=false](https://books.google.mk/books?id=aQXeBgAAQBAJ&pg=PA19&lpg=PA19&dq=As+far+as+Lean+methodology+is+concerned,+the+only+way+to+determine+if+something+has+value+or+not+is+to+consider+whether+a+customer+would+be+willing+to+pay+for+it&source=bl&ots=bPSwNW6XMw&sig=5ze7Si2qsTmtwPBwzQW64-5Zvs4&hl=en&sa=X&ved=0ahUKEwit2svy583ZAhUBfFAKHwDgAvoQ6AEIOjAC#v=onepage&q=As%20far%20as%20Lean%20methodology%20is%20concerned%20C%20the%20only%20way%20to%20determine%20if%20something%20has%20value%20or%20not%20is%20to%20consider%20whether%20a%20customer%20would%20be%20willing%20to%20pay%20for%20it&f=false), page 19, date 02.03.2018

⁵ Kaizen Institute (2015), What is the difference between Kaizen, Lean & Six Sigma?, <https://in.kaizen.com/blog/post/2015/09/11/what-is-the-difference-between-kaizen-lean--six-sigma.html>, date 02.03.2018

⁶, <https://www.isixsigma.com/dictionary/8-wastes-of-lean/>, date 20.03.2018

O – Over production – Making more than is IMMEDIATELY required

O – Over processing – Tighter tolerances or higher grade materials than are necessary

D – Defects – Rework, scrap, incorrect documentation

S – Skills – Underutilizing capabilities, delegating tasks with inadequate training

Among the 12 principles:⁷ teamwork empowerment, training, motivation, continues improvement, job rotation & communication are directly HR Management accountability. **Therefore conserving the S – skills and 12 principles it's important to have alighted HRM strategy that will support the principles and flows of lean.**

a. KAIZEN IN LEAN

On the other side, to the knowledge of the author, more often Lean is related with Kaizen terminology. The combination Lean and Kaizen can be found very beneficial in manufacturing. Lean Kaizen helps you get rid of waste and continuously implement best practices.⁸ Kaizen (mindest) steers toward Continuous Improvement but in small steps, not a radical breakthrough (innovation). As a philosophy, Kaizen is about building a culture where all employees are actively engaged in suggesting and implementing improvements to the company.⁹ Kaizen and pure continuous improvement are very much about making improvements for the sake of improvement not for correcting a problem.¹⁰ In kaizen culture it is used personal creativity and ingenuity to identify problems and then develop and implement ideas to solve those problems.¹¹

⁷ Awaritoma O (2010) Master thesis, Performance management in lean production, a Case study, 2010, Linnaeus University School of Management and Economics Department of Business Administration, Page 108, <https://www.diva-portal.org/smash/get/diva2:357555/FULLTEXT01.pdf>, date 02/03/2018

⁸ Lean Kaizen: A Simplified Approach to Process Improvement, <https://asq.org/training/lean-kaizen-a-simplified-approach-to-process-improvement-kaizen>, date 16.03.2018

⁹ Vorne, <https://www.leanproduction.com/kaizen.html>, date 02.03.2018

¹⁰ Lean Manufacturing Tools, Techniques and Philosophy | Lean and Related Business Improvement Ideas, <http://leanmanufacturingtools.org/621/what-is-kaizen/>, date 06.03.2018

¹¹ Kaizen Institute – (2015), What is the difference between Kaizen, Lean & Six Sigma?, <https://in.kaizen.com/blog/post/2015/09/11/what-is-the-difference-between-kaizen-lean--six-sigma.html>, date 02.03.2018

According to the research paper focused with Kaizen methodology¹², there are some models to relative environmental profiles of:

- new material choices or packaging options.
- to reduce environmental impact at its source in the design phase.
- to serve as a communication tool between companies and consumers
- to establish from the design stage the re use of some materials,
- to identify which are the recycle materials.
- to compare existing products with planned alternatives
- to compare existing company products with products of competitors
- realize an internal information and training
- new strategies in marketing, advertising policies
- joining eco-criteria
- environmental cost allocation
- assess the gap from eco-label criteria
- radical changes in product life cycle

For good implementation, the good signalization is necessary. Therefore we describe Kanban under.

i. KANBAN

Kanban has meaning of “visual card” in Japanese. The process of constant improvement for the Kanban system is more rapid and fast.¹³ Kanban is seen as a tool or methodology in Kaizen. In Kanban there is no limites in terms of time, but there is limits in terms of work-in-progress per person and is small enough to avoid unworthy tasks but big enough to reduce idle personnel.¹⁴ The General Practices of Kanban

¹² Boca G. D. (2011) International Scientific Conference Young Scientists 2011, Kaizen Method in Production management, http://www3.ekf.tuke.sk/mladivedci2011/herlany_zbornik2011/boca.pdf, page 18&19, date 02.03.2018

¹³ Wilson M. (2013) The Kaizen And Kanban Principles, Kaizen-News, <https://www.kaizen-news.com/the-kaizen-and-kanban-principles>, date 02.03.2018

¹⁴ Scrum vs Kanban boards: 11 major differences, <https://realtimeboard.com/blog/scrum-kanban-boards-differences/#.Wp65CWrwbIU>, date 06.03.2018

define essential activities for those managing Kanban systems and there are six of them:¹⁵

- Visualize.
- Limit work in progress.
- Manage flow.
- Make policies explicit.
- Implement feedback loops.
- Improve collaboratively, evolve experimentally.

Some research findings show that kanban system is essential in ensuring the success of Just In Time production and create smooth flow of part throughout manufacturing system.¹⁶ Indicated on the kanbans is the name or serial number for product identification, the quantity, the required operation and the destination of where the part will travel to.¹⁷

When discussing about Kaizen in Lean since Kaizen is linked to a culture, in the same time there is a significant and continuous need of HRM in terms of supporting the respective culture and its values.

Moreover, another approach beside Lean is 6 sigma.

4. SIX SIGMA

We can say that the beginning of 6 sigma is with TQM (Total Quality Management). TQM includes both an empirical component associated with statistics and an explanatory component that is associated with management, of both people and processes.¹⁸ Six Sigma is a more specific form of process improvement that narrows its focus

¹⁵ Anderson D. J. and Carmichael A (2016), Essential Kanban Condensed, page 17

¹⁶ Naufal Bin Adnan A at all (2013) Industrial Engineering Letters Vol.3, No.6, 2013, <https://pdfs.semanticscholar.org/1f56/c58fe3913c8d91543387c5bc713aafa3bded.pdf>, date 06.03.2018

¹⁷ Kootanaee A J et all. (2013), International Journal of Economics, Business and Finance, Vol. 1, No. 2, March 2013, PP: 07 – 25, http://ijebf.com/IJEBF_Vol.%201,%20No.%202,%20March%202013/Just-in-Time%20Manufacturing%20System%20%20Just-in-Time%20Manufacturing%20System.pdf, date 06.03.2018

¹⁸ Anvari A, Ismail Y and Hojjati S. M. H. (2011) World Applied Sciences Journal 12 (9): 1585-1596, 2011, A Study on Total Quality Management and Lean Manufacturing: Through Lean Thinking Approach, Page 1856, http://www.improvegroup.net/images/ig_library_downloads/Case_Study.pdf, date 02.03.2018

(not like 8 wastes in lean) on improving the quality of the final product.¹⁹ Its two project methodologies – DMAIC (define, measure, analyse, improve, control) and DMADV (define, measure, analyse, design, verify) are based on Deming’s Plan-Do-Check-Act cycle.²⁰ Under, ar shown the tools that can be used during a DMAIC (define, measure, analyse, improve, control) specifically, for each stage.

| TOOL NAME | CYCLE STAGE | | | | |
|-----------------------------|-------------|---|---|---|---|
| | D | M | A | I | C |
| Affinity Diagram | X | | X | | |
| Brainstorming | | | X | X | |
| Business Case | X | | | | |
| Cause-and- Effect Diagrams | | | X | | |
| Charter | X | | | | |
| Consensus | | | | X | |
| Control Charts | | X | X | X | X |
| Continuous data | | | | | |
| Individuals | | | | | |
| X-Bar_R | | | | | |
| EWMA | | | | | |
| Discrete data | | | | | |
| p, np | | | | | |
| c, u | | | | | |
| Critical to Quality Tree | X | | | | |
| Data Collection Forms | | X | X | X | X |
| Check Sheet | | | | | |
| Pfrequency Plot Check Sheet | | | | | |
| Confirmation Check Sheet | | | | | |
| Concentration Diagram | | | | | |
| Data Collection Plan | | X | X | X | X |
| Design of Experiment | | | X | X | |
| Full Factorial | | | | | |
| Reduced Fractions | | | | | |
| Screening Designs | | | | | |
| Pracket-Burnham Designs | | | | | |
| More than Two Levels | | | | | |
| Flow Diagrams | X | X | X | X | X |

| TOOL NAME | CYCLE STAGE | | | | |
|--|-------------|---|---|---|---|
| | D | M | A | I | C |
| Frequency Plots | | X | X | X | X |
| FMEA (Failure Mode & Effect Analysis) | | X | | | |
| Gate R & R | | X | | | |
| Hypothesis Tests | | | X | | |
| t-test | | | | | |
| paired t-test | | | | | |
| ANOVA | | | | | |
| Chi Square | | | | | |
| Kano Model | | X | | | |
| Planning Tools | | | | X | |
| Gantt Charts | | | | | |
| Planning Grid | | | | | |
| Pareto Charts | | X | X | X | |
| Prioritization Matrix | | X | X | | |
| Process Capability | | X | X | | |
| Process Sigma | | X | X | | |
| Quality Control Process Chart | | | | | X |
| Regression | | | X | | |
| Rolled Throughput Yield | X | | | | |
| Sampling | | X | X | X | X |
| Scatter Plots | | | X | | |
| SIPOC (Suppliers, Inputs, Process, Outputs, Customers) | X | | | | |
| Stakeholder Analysis | X | | | X | |
| Standardization | | | | | X |
| Stratification | | X | X | X | X |
| Stratified Frequency Plots | | | X | | |
| Time Series Plots (Run Charts) | | X | | | |
| VOC (Voice of the customer) | X | | | | |

Table 1 Tool vs DAMIC Cycle stage.²¹

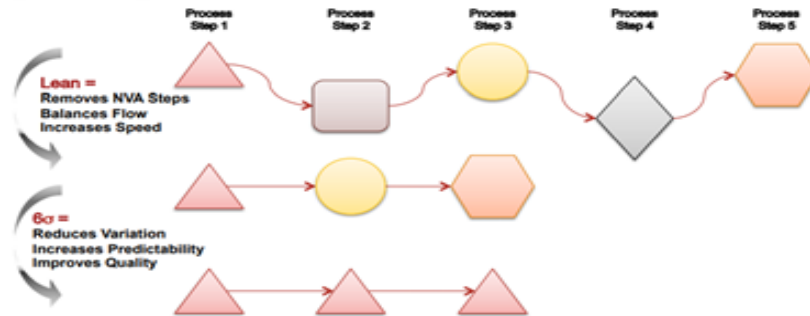
a. LEAN 6 SIGMA

Lean Six Sigma Methodology focuses on cutting out or minimizing non value added (NVA’s) and eliminate wastes out of process so that only steps that directly add value to the product and some critical steps that adds value to business are performed.²² Lean Six Sigma came into existence which is the combination of Lean and Six Sigma. The fusion of Lean and Six Sigma is required because.²³

¹⁹ Six Sigma vs. Kaizen, <https://www.sixsigmaonline.org/six-sigma-training-certification-information/six-sigma-vs-kaizen/>, date 16.03.2018
²⁰ Kaizen Institute (2015), What is the difference between Kaizen, Lean & Six Sigma?, <https://in.kaizen.com/blog/post/2015/09/11/what-is-the-difference-between-kaizen-lean--six-sigma.html>, date 02.03.2018
²¹ Longo E (2012), [http://academic.uprm.edu/ispeprsc/media/\(2012.04.28\)_Principles_of_Lean_Six_Sigma_2012.pdf](http://academic.uprm.edu/ispeprsc/media/(2012.04.28)_Principles_of_Lean_Six_Sigma_2012.pdf), date 12.03.2018
²² Pannu B S (2018) Why Lean Six Sigma when Six Sigma Methodology exists?, <http://globalskillup.com/lean-six-sigma-methodology/>, date 12.03.2018
²³ Vivekananthamoorthy N and Sankar S (2011). Lean Six Sigma, Six Sigma Projects and Personal Experiences,

- Lean cannot bring process under statistical control, and
- Six Sigma alone cannot dramatically improve process speed or reduce invested capital.

Moreover, the picture under visually represents the differences of Lean & Six sigma:



Picture 2 - Lean & Six Sigma²⁴

Via implementation Lean and Sigma, it is logical to conclude that HRM should play an important role in preparing the people at all level and functions for the integration of both approaches.

5. AGILE

Other than Lean approach, the Agile approach is mostly common to IT industries. An agile company is usually very flexible, quickly adapts to changes, iterates less while implementing faster, and is able to seize new opportunities as they appear.²⁵ In agile it is come to value.²⁶

- Individuals and interactions over Processes and tools
- Working software over Comprehensive documentation
- Customer collaboration over Contract negotiation
- Responding to change over Following a plan

Prof. Abdurrahman Coskun (Ed.), InTech, <http://www.intechopen.com/books/six-sigma-projects-and-personal-experiences/lean-six-sigma>, date 12.03.2018

²⁴ Bridge C (2016) Overview of Lean Six Sigma, PricewaterhouseCoopers Public Sector, Page 17,

https://ipmanc.memberclicks.net/assets/2016conference/chelseabridge_2016ipmatrainingforum.pdf, date 12.03.2017

²⁵ https://realtimeboard.com/blog/choose-between-agile-lean-scrum-kanban/#.Wp_iamrwbIU, date 07.03.2018

²⁶ Tutorialspoint simply easy learning (2014),

https://www.tutorialspoint.com/agile/agile_tutorial.pdf, date 07.03.2018

Therefore, in software development, if the applied development method is an agile one that can be verified if:²⁷ software development is incremental (small software releases, with rapid cycles), cooperative (customer and developers working constantly together with close communication), straightforward (the method itself is easy to learn and to modify, well documented), and adaptive (able to make last moment changes).

Agile Methods include: Extreme Programming, Scrum, Crystal Methods, Feature Driven Development, Lean Development, and Dynamic Systems Development Methodology.²⁸

Organizations that are trying to adopt agile methods for the first time should be aware of the risks if agile is not well understood because agile has not set any standard process to follow as agile manifesto says “people over process”.²⁹ The keys to success in agile are:³⁰ communication, dedicated teams and good planning. Like in lean, also in agile the continued improvement is a goal. Therefore we describe kaizen elements in agile as well.

a. KAIZEN IN AGILE

The following four elements are essential to implement Agile Kaizen:³¹

- Problem understanding and improvement planning on the shop floor, by the people working in the process that needs improvement.
- A management which takes its responsibility as driving force and supporter of improvement seriously.

²⁷ Abrahamsson P et al (2000), Agile Software development methods, review and analysis, page 17, <http://www.vtt.fi/inf/pdf/publications/2002/P478.pdf>, date 07.03.2018

²⁸ D. Cohen ET AL. (2004), An Introduction to Agile Methods, page 12, http://www.cse.chalmers.se/~feldt/courses/agile/cohen_2004_intro_to_agile_methods.pdf, date 07.03.2018

²⁹ Shankarmani R et al. (2012), Agile Methodology Adoption: Benefits and Constraints, International Journal of Computer Applications (0975 – 8887) Volume 58– No.15, <https://pdfs.semanticscholar.org/f600/cf9d961ee3351de10a4bb4c88a78ac4ff41c.pdf>, date 07.03.2018

³⁰ Agile handbook by Philosophie, <http://agilehandbook.com/agile-handbook.pdf>, date 07.03.1028

³¹ Gross J A (2014) Agile Kaizen: Speeding Up Continuous Improvement, <http://thekaizone.com/2014/06/agile-kaizen-speeding-up-continuous-improvement/>, date 16.03.2018

- Changes that can be implemented and tested quickly. These changes may be radical nevertheless, if they find the right lever against root causes.

- Using the Lean Startup adage “Fail fast, fail cheap, fail often” as building part of continuous improvement.

For good implementation, the good signalization is necessary. Therefore we describe Scrum under.

In Agile management, the HRM should play a role in implementation a systems, programs and strategies that foster expertise, collaboration and decision-making.³²

i. SCRUM

Scrum is a methodology that effectively employs project management throughout the cycle of project, is adaptive to change of requirements, focuses on user participation and suitable for Web applications, making it suitable for adoption in web development.³³ Scrum has three roles: Product Owner, Scrum Master, and Team.³⁴ When the values of commitment, courage, focus, openness and respect are embodied and lived by the Scrum Team, the Scrum pillars of transparency, inspection, and adaptation come to life and build trust for everyone.³⁵ This focus on continuous improvement through “inspect and adapt” is supported in the Scrum framework at 3 points in the process as follows:³⁶

- The Daily Scrum meeting allows the team to focus on their commitment for the current Sprint and whether they are still on track to deliver on that commitment.

- The Sprint Review meeting allows customers to view a potentially shippable product increment created by the Team and provide feedback that adjusts the Product Backlog contents and priorities.

³² Geplaatst (2017) New roles and rules for HR,

<http://drivehrmconsultancy.nl/category/geen-categorie/>, date 16.03.2018

³³ Mishra A (2014), Benefits Of Combining WSDM And Scrum Framework For Web Development, International journal of scientific & technology research Volume 3, issue 7, page 329, <http://www.ijstr.org/final-print/july2014/Benefits-Of-Combining-Wsdm-And-Scrum-Framework-For-Web-Development.pdf>, date 07.03.2018

³⁴ <http://scrummethodology.com/>, date 02.03.2018

³⁵ Schwaber K. and Sutherland J (2017), The Scrum Guide™

<https://www.scrumguides.org/scrum-guide.html#values>, date 02.03.2018

³⁶ sterling C (2008), A kaizen mindset, <http://www.gettingagile.com/2008/11/22/a-kaizen-mindset/>, date 06.03.2018

- The Sprint Retrospective enables the Team to improve the process they use to delivery software each Sprint

Some conclusions from a research in software development can be drawn as follows:³⁷

- The quality and project risks seen more quickly.
- Business Change and Customer Feedback will be visible in the final sprint.

- Speed of visible projects in real time.
- Live Application can be done per product backlog.

The leading variant of Agile is **Scrum**, the practices of Scrum include the following easily understood practices that facilitate agility:³⁸

- Work is organized in short cycles
- Management doesn't interrupt the team during a work cycle.
- The team reports to the customer, not the manager.
- The team estimates how much time work will take.
- The team decides how much work it can do in an iteration.
- The team decides how to do the work in the iteration.
- The team measures its own performance.
- Work goals are defined before each cycle starts.
- Work goals are defined through user stories.
- Impediments to getting the work done are systematically removed.

6. CONCLUSION

Kaizen – for no problems

Lean – for no waste

Agile – for incremental improvements

Six Sigma – for no variations

³⁷ Permana P A G et all (2015) Scrum Method Implementation in a Software Development Project Management, International Journal of Advanced Computer Science and Applications, Vol. 6, No. 9, page 204, https://thesai.org/Downloads/Volume6No9/Paper_27-Scrum_Method_Implementation_in_a_Software_Development_Project_Management.pdf, date 07.03.2018

³⁸ Denning S (2012), How Manufacturing Can Learn From Software To Become Agile, Forbes.com, <https://www.forbes.com/sites/stevedenning/2012/09/24/how-manufacturing-can-learn-from-software-to-become-agile/#3b9f2613bd6b>, date 06.03.2018

In every organisation, section, department or team, the immediate employees know the business best or can find the root cause of the issues better than the any other party. The solution therefore should come from the immediate employees, or at least consultation is recommended. Moreover, HRM should pay attention to support the definition the optimal solution for improvement. Also, during the implementation of various tools and methods HRM should intervene to sustain a sense of ownership as to be obtained and sustained a desired level of performance in long run. Issues get refined for more systematic investigation and formulations based on the philosophies / methodologies / tools. On the other side HR should take measures for the training of people that parallel to the methodologies adopted and tools implemented in Lean / Agile.

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2. Lean Manufacturing, LeanConsultingWorks, LLC, <http://www.leanconsultingworks.com/lean-manufacturing.htm>, date 02.03.2018
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AvoQ6AEIOjAC#v=onepage&q=As%20far%20as%20Lean%20methodology%20is%20concerned%2C%20the%20only%20way%20to%20determine%20if%20something%20has%20value%20or%20not%20is%20to%20consider%20whether%20a%20customer%20would%20be%20willing%20to%20pay%20for%20it&f=false , page 19, date 02.03.2018

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