

OPTIMIZATION OF SELECTED PROCESSES IN A COMPANY WITH THE SUPPORT OF THE LEAN CONCEPT

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The aim of the paper is to present the importance of management and optimization of administrative processes in a company with the support of the Lean concept. The research part deals with the most popular approaches in business process management using lean manufacturing and the methods and tools used to improve production processes within this trend. The case study focuses on the issue of administrative activities and processes in the organization, and on improving these processes by applying the lean concept using project management. It includes an analysis of the selected administrative process, the identification of the various forms of waste in it and a description of achieved results of the improvement in the particular project. This paper presents a new methodology for the application of lean administration tools in the company conditions.

KEYWORDS

lean, lean administration, process management, organization, optimization

1 INTRODUCTION

The article focuses on the issue of administrative activities and processes in the organization, and on improving these processes by applying the lean concept using project management. It includes an analysis of the selected administrative process, the identification of the various forms of waste in it and a description of achieved results of the improvement in the particular project. This paper presents a new methodology for the application of lean administration tools in the company conditions.

2 LEAN MANAGEMENT PRINCIPLES

For all organizations it is always important to perform its tasks and services in the most efficient way and to adapt continuously to new and increasing needs and requirements [Pelantova 2016]. Lean production is a complete system that welds the activities of everyone from top management to line workers, to suppliers, into a tightly integrated whole that can respond almost instantly to marketing demand from consumers [Dibia et al. 2010].

The overall objective of Lean is to create a culture for continuous improvement based on a strong involvement of all integrated employees. The core idea of Lean is to maximize customer value while minimizing waste. Thus, lean means creating more value for customers with fewer resources, and has a strong focus on the processes for creating the results and the need to be systematic and to measure and report on results of the improvement.

Even if Lean mainly was developed for use in the industrial production sector it has an increasing degree found in its application in the service sector and the public sector, for instance for improving the efficiency of insurance companies or hospitals. The reason for this is that Lean is based on some rather simple principles and practical methodologies that can be adapted for analysing and solving different tasks [Byfuglien 2013].

The five basic principles in Lean are:	
1 Value	What creates value for your customer?
2 Value stream	Avoid waste: Identify those activities that create waste
3 Flow	Create flows that runs as smoothly as possible – few stops
4 According to needs	Actions/flows are created based on the needs of your customers.
5 Continuous improvement	Create a culture where all contributes to continuous improvement

Figure 1. The five basic principles in Lean

Reduction of waste is essential in Lean and thus it is also necessary what waste can mean: Waiting, inefficient movements, resources not fully used, unused creativity, unnecessary transport, corrections with low importance and value, too large stocks, or over production.

2.1 HR in Lean Organizations

By every lean organization a broad, continuous, intelligent and self-reinforcing human resources are needed. They are the initiative of processes, they are the initiative of business activities, they see prospects and challenges of the future, they are the hands of continuous improvement, the eyes of true quality and they are the true face of the lean concept. Only the best suited human resources can continuously achieve the expected and only that is good enough for a sustainable Lean system. So, it is expedient that only the best candidate should be recruited or selected for employment. It is also of great importance that for the already existing workforce, their job performance is well accessed and appreciated. The human resources structured in work teams must be well built, capable, skilled, swiftly efficient, united, strategically autonomous, fully focused, brilliantly directed and adequately motivated [Dibia et al. 2010].

If all these are well matched with a scoreboard to track their progress and its assessment metrics which must point in a steady and consistent direction towards the ideal state. It is owned and used by the people who own the process, a consistent, self-driven and suitable human resources which in themselves are lean and will emerge for a successful implementation and sustenance of the lean production system. The effective combination of human resources and automation is very important to ensure continuous qualitative improvement.

Literature on lean manufacturing argues that the critical factor in implementing changes and tying all the components of the system together is drawing fully on the mental powers of all employees in the production process not just management or engineers. Even the newest mechanics and operators have some insight into the machines, the processes, and the practices based on their day-to-day experiences. This is a source of expertise that can be tapped in any effort to make plants more efficient. As holders of critical expertise, manufacturing operators should be given the authority to make decisions relevant to their work, without having to get approval from a manager for routine decisions. They should also expect to have their suggestions for improvement carefully evaluated for non-routine areas or areas where a part and process quality are critically engineered. Without the assistance and buy-in of

all participants in the value chain, organizations will not be able to make the change to lean manufacturing.

[Womack 1996] suggest that “It has become conventional wisdom that higher levels of management should learn to listen to the primary work team since they know the most about how to get the job done.” The authors indicate, however, that this is not quite enough, that workers must be trained to understand pull techniques and in problem-solving methods. In his description of manufacturing improvements at [Hughes 1996] suggests that along with low WIP inventory, early and intensive worker involvement was key. A number of practices help the workforce to contribute to manufacturing improvements. The primary one is a management attitude toward production workers—they must be considered resources with the potential to contribute to improvements as well as to an actual task completion. The lean HRM philosophy is best summed up by those managers who consider their production workers to also be process engineers. A second aspect of lean HRM is maintaining a flexible workforce. This has two aspects. First, the workers must receive training on the new methods of production. One lean practice is “operator self-inspection, „where production workers are responsible for checking the quality of their outputs. If they are given this responsibility, they need training on such quality processes as SPC (Statistical Process Control). If they are given responsibility for routine machine maintenance, they must be trained to do this. Both of these skills reduce the need for support personnel on the floor (quality inspectors and maintenance personnel) and reduce machine downtime while workers wait for the support personnel to provide the required services. In addition, the machine operator is in the best position to know when maintenance downtime can be optimally performed, based on forecast machine scheduling. Furthermore, training in root-cause analysis helps workers get to the bottom of production problems and helps reduce their occurrence.

Another method by which lean HRM practice incorporates workers more fully into the production process is by developing production work teams. Workers get a chance to talk about quality and other production issues with the others. Teams offer management a formal mechanism to use in tapping their workers’ skills and knowledge when trying to solve a production problem or to improve processes through kaizen events. As was discussed with reference to product design, structures break down barriers between functions and improve communication. More effective product development and more manufactural products can result. IPTs can and should operate through the life of the product, not just during the design phase, although their emphasis may change somewhat during each program phase.

They should also enable cooperation and communication that can result in fewer levels of management (The Toyota model calls for self-managed work teams, which were not in evidence anywhere in the defence aircraft sector), Matching lean manufacturing’s call for flexible machines and work cells is its emphasis on a flexible workforce. With a well-trained workforce and few job classifications, production workers should be able to be reassigned to different processes as needed.

Lean HRM practices suggest that workers receive extra pay as they are trained on and become expert on more processes in the plant. Implementing this practice in union plants requires careful management and negotiation, however, as job classification falls into the “wages, hours, and working conditions” negotiation arena. Unions are often loath to give up the accepted and negotiated structure of job classifications

because of the fear of attendant loss of power or without other concessions from management. They also seek to avoid a reduction in their membership (Making it work).

2.2 Lean HR Processes

The Lean approach builds on a long history of methods for a process control and quality management dating back to around 1900 with the Henry Ford and the development of the assembly line and including Total Quality Management around 1990 and later on EFQM (European Foundation for Quality Management), ISO, Six Sigma, CAF (Common Assessment Framework), JIT (Just in Time) and QAF (Quality Assessment Framework) as developed within the European Statistical System [Eurostat 2011]. Important contributions to this development has been Mr. W. Edwards Deming, Mr. Joseph Duran and Mr. Kaoru Ishikawa. Experiences of the Toyota Production System (TPS) is also an element in development of Lean [Juran 1988].

The cost of operating HR processes can be enormous invisible and unmeasurable. HR is good in introducing bureaucratic and lengthy complex processes. HR acts as the internal police department in most companies. HR does not focus on the total costs of its processes. The HR processes are expensive because many of them involve all managers and employees. It multiplies the total costs for the organization. The managers and employees cannot focus on their primary tasks and processes. They have to work for Human Resources. They have to devote their working time to “non-productive” processes, which they are obliged to follow. For example, the cost of the performance appraisals can be inequitable with the produced results if the detailed comparison and analysis is conducted.

The HR processes have to be redesigned. The HR Organization has to be changed. The responsibilities of team members have to be larger in scope than HR Roles and responsibilities allow today. The empowerment of the HR employees has to be widened. Lean processes cannot be introduced without a significant underlying change of the corporate culture. The HR Management Philosophy in the team needs to change.

HR has to make a deep analysis of the corporate culture. The culture has to support the lean process methodology. The employees have to make decisions, and they have to be responsible for them. They cannot make no decisions. Each time, the employee who has made the decision has to be visible. That is part of the lean thinking in Human Resources. The lean HR Processes are usually about empowering employees and managers. HR has to set broad policies, and it has to monitor and control processes. In case of the occasional misuse, it has to act quickly, but it does not have to change the process. The manager and the employee can receive a gentle warning. (Introduce Lean HR Processes)

3 METHODOLOGY OF APPLICATION OF LEAN ADMINISTRATION TOOLS.

This methodology adjusts an application of methods and tools of lean administration on the example of a chosen company. The case study originally uses data of a project “Lean administration” realised in this company within the period August – November 2014 in cooperation with the API (Academy of productivity and innovation, Ltd.). The proposed methodology consists of the description, aim and function of methods/tools and their application process.

3.1 Identification of internal processes and their evaluation

The selection of the target project is based on the identification of current internal processes and their evaluation. They are assessed from the standpoint of potential for improvement on the basis of selected criteria. First of all for the intended improvement it is crucial to identify processes and compile a matrix of selected processes.

It is crucial:

- to set up a list of internal processes and their measurable parameters for each process,
- in a team evaluate significance (strength of relation) between proposed measurement and the variable describing a given parameter (characteristics).

The method used for the selection of the targeted project with the highest potential is call "Razor". The selection is performed based on further criteria as consideration of the importance, measurability, possible improvement (of a change), improvement of a time aspect (within a time period for the project realization).

3.2 Project management based on DMAIC

DMAIC method represents a structured procedure of managing of improvement activities. Its name is based on first letters of individual phases of this method. Namely it means Define, Measure, Analyze, Improve, and Control. By means of the application of suitable methods and tools in individual phases is possible to accomplish improvement of a selected process.

A brief description of each phase includes (see Fig. 2):

- Define – setting of a project objective and its extend,
- Measure – description of a current state and evaluation of a process performance,
- Analyze – specification of key causations and identification of problems,
- Improve – problem’s solving and implementation of changes,
- Control – prevention of reverse effect and maintaining of attained state.

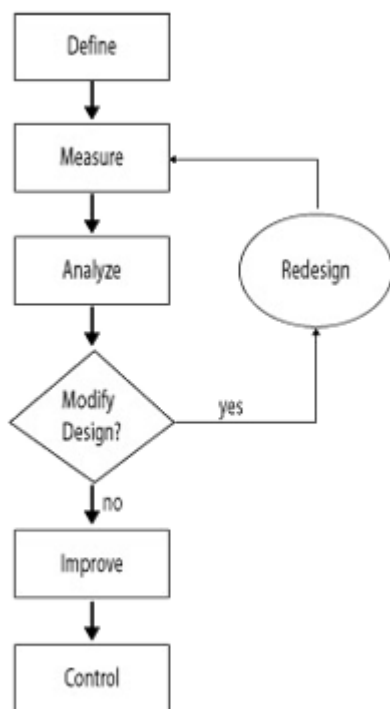


Fig.2 DMAIC Quality Strategy Scheme (ASQ, 2017)

Determination of project extent and definition of objectives (Define).

The aim of this first phase is to understand the current process, delimit reasons why to solve the project, define the project extend, its steps, aims, form the project team a get a rough description of the process (outputs and inputs).

This phase involves also time schedule (action plan) and designation of communication needs. It means that it si necessary:

- To identify and define the problem which needs to be solved.
- Determine the project extent.
- Compile the project plan.

Description of a current state (Measure)

The aim of the second phase is a detailed description of an administrative process focused on a measurement of current performance lever of this process. The output brings clearly defined measures (criteria) of the performance (efficiency) and understanding how the process currently works.

Procedure:

- illustrate current process,
- propose a measurement system,
- define current efficiency of a process.

Identification of wasting (Analyze)

The aim of this third analytical phase Is to identify wasting, pinpoint root causes of problems and verify hypotheses and an influence on indicators.

Procedure:

- identify potential causes,
- evaluate important influence,
- express conclusions of the analysis.

Problem’s solving and implementation of changes (Improve)

The fourth phase ensures elaboration of proposals of measurements which eliminate a problem, realisation of measurements (implementation of changes), testing of a solution, risks identification, creation of the targeted process model.

Procedure:

- create innovate solutions using technology and discipline,
- choose and verify solution,
- develop and deploy implementation plan

Prevention of reverse effect and maintaining of attained state (Control)

The main purpose of the last phase is stabilize changes and maintain attained situation. It means to prepare a plan of process management, composition of management tools, monitor and maintenance of efficiency, evaluation of efficiency in a real working environment, collecting of materials for continuous improvement and control.

Procedure:

- implement changes into standard documentation
- create controlling plans to ensure continuous improvement,
- to monitor critical indicators,
- to ensure overtaking of responsibility for implemented changes,
- to prepare final report of the project,
- summarize and share positive results.
- prevent reverting back to the “old way”
- require the development, documentation and implementation of an ongoing monitoring plan
- institutionalize the improvements through the modification of systems and structures (staffing, training, incentives)

4 OPTIMISATION OF AN ADMINISTRATIVE PROCESS „EMPLOYEE ATTENDANCE“

As a pilot project with the highest potential for the improvement there was selected an issue of optimisation of an administrative process – employee attendance.

Project name:

Attendance in Power Key (PWK) information system

Project beginning: 28. 8. 2014

Expected project end: 31. 12. 2014

Potential savings (expected project benefits):

Problem solution (within project realisation) should bring savings of time of a payroll accountant (12hours/month, 7 % in a capacity of working hours), savings in printing of paper forms, (as holiday, spare time, correction of the attendance), time reduction of the period between mistakes and their corrections etc.

Project is described as an implementation of shifts plans in a company, implementation of workflow for the absence, training of managers for corrections in the attendance.

Project was selected for these reasons:

- cancelling of paper forms,
- accuracy of reporting (overtime productivity),
- time demand of planned shifts,
- prolonged process of the time between errors and their correction,
- responsibility of managers for the attendance of their subordinates.

A problem definition specified high amount of errors in the evidence of employee attendance, inaccuracy in data for reports, archiving of paper forms, absence of a plan for shifts.

Process Owner: HR

Project aim:

- to save number of working hours of the payroll accountant from 40 hours/month to 3hours/month.,
- to save printing of paper forms in HR from 350 pc/month to 20 pc/month,
- precise of data – decreasing of errors in the attendance from 60 to 5,
- implementation of a **plan of shifts in the company** .

Partial project objectives – planning module implementation including a workflow into a Power Key for two shifts, time savings for the payroll accountant, savings in printings of paper forms, accuracy of attendance data, planning shifts in the company.

Expected benefits (benefits for customers – employee’s, supervisors, leaders, managers):

- for employees – better overview of planned absence, easy system of changes and control,
- for leaders – overview in a shift plan, summary of numbers of employees in shifts, reduction of communication with the HR department, speed up of processing of the attendance evidence.
- for managers – better overall overview of employees.

The project team was created from 8 employees including a project manager.

The crucial risk and limitation can be seen in a negative approach of employees, in deceptions, technical problems and a long process of employee training.

Process inputs:

New modules of PWK – The analysis of a shift plan, report productivity, analysis of time demanding with PWK, a handbook of training PWK.

Process outputs:

Training of managers for a work with PWK, training of employees for work with workflow, direct data for reporting.

Project includes: training of all company employees in new modules, creation of a handbook.

Project does not include: solution of a process of TC3 shift’s planning, solution of processes of productivity calculation, data on sickness rate and doctors.

Project procedure:

- 1) identification of key projects (wasting and opportunities),
- 2) list of internal processes and evaluation of attractiveness for the improvement,
- 3) selection and project assignment,
- 4) using of the DMAIC method,
- 5) SIPOC Process diagram (Supplier, Input, Process, Output, Customer) process,
- 6) definition of KPI (key performance indicators),
- 7) measurement realisation – time frame of a day,
- 8) process map of holiday approval and correction of the attendance,
- 9) analysis of mistakes in the evidence of the attendance,
- 10) phase of improvement – training of employees for new modules of the attendance,
- 11) role and responsibility definition for new modules,
- 12) verification of KPI,
- 13) control – prevention of reverse effect.

4.1. Phase Define

To get important and necessary information for the following analysis there was used diagram SIPOC (Fig. 3), which provided simplified overview of the whole process and helped thus to clarify the whole process. Its application identified process borders, its scale and list of key outputs and customers, inputs and suppliers. Moreover there were identified and lined up the main project steps.

Suppliers	Inputs	Process	Outputs	Customers
Employees	Form Holiday	Evidence of the presence at the terminal	Correction of the attendance list	Employees
Head of departments	Form Compensatory Time off	Completing of the form Absence	Export of Week Report	Head of departments
Coordinator	Form Doctor	Approval of the form, submission to the HR department	Export of Salary report	Financial and Tax Office
IT people	Form Correction of Attendance	Completing of absences in Power Key system		
External company	Attendance card	Correction of mistakes		
		Approving of the presence		
	Power Key system	Completing the form for salary approval		
	PC, terminal			

Figure 3. Process diagram SIPOC

For coordination a harmonisation of activities and individual necessary steps there were used as an organisational support a schedule of activities and timeline during the period from 15. 9. 2014 to 31. 10. 2014. The schedule contains except of deadlines also responsible people and evaluation of success in the realisation of activities.

4.2. Phase Measure

The situation before the project beginning is possible to describe in a simplified way as a system of several paper forms (request forms for holiday, unpaid leave, and a form of corrections in the attendance evidence system). The time from filling in a form, confirmation by a manager and processing in HR department took up to one week.

To describe the current state there was crucial to get detailed information – to measure critical process and its parameters.

Key indicators of the efficiency were defined as:

- time consumption
- incidence of incorrect records.

The project aim was to decrease total labour intensity. Currently 10.8 hours decrease in 20 % and speed of repairing, which was originally 4 days, decrease 75 %. The measurement period for incorrect records (data collection) was set between 1. 10. 2014 and 21. 10. 2014 (3 weeks).

The measurement extent was defined as a number of individual types of errors in the attendance evidence in the whole company and in two selected shifts. As the method for the measurement of time was used the day time snapshot – recording of time and the incidence of tracked activities during these shifts.

4.3. Phase Analyse

To find out the core causes, it means causes of incorrect records of attendance, there was used the Ishikawa diagram (fish bone diagram). There were chosen five main categories of causes (evidence of visitors, mistakes in the evidence of work arrival or leaving, the whole day was missing in the evidence or arrival/leaving was missing).

Basic steps:

- identification of errors in the attendance evidence,
- cause analysis of mistakes,
- proposal of steps to prevent errors.

The result of the analysis were preventive measures – system settings and employee training.

4.4. Phase Improve

The analysis pointed out, that the problem solution is based on the system settings and employee and management training. For the attendance module there was created a qualification matrix (see Figure 4), which defines new roles and responsibilities in this process.

QUALIFICATION MATRIX FOR ATTENDANCE MODULES					
Position	Correction	Planning of administration	Planning of shifts	Administration of requests	Workflow
employee	x	x	x	x	administrator
foreman	administrator	x	preview	x	x
TC	administrator	administrator	administrator	administrator	x
Head of dep.	administrator	administrator	x	administrator	x
CEO	administrator	administrator	administrator	administrator	x

Figure 4. Proposal to define roles and responsibilities for the attendance module

The new process of the absence approval is necessary to standardize – namely to implement in the set of working rules and integrate new responsibilities of superiors (managers) in the job description and plan of training. As the Fig. 5 Implementation, proposed measures and changes brought positive results.

Power key Activity	Starting State		After change	
	Number of operations per months	Time consumption for HR staff per month	Number of operations per months	Time consumption for HR staff per month
Doctor, disease	103	1:15	103	1:15
Business Trips	20	1:27	20	1:27
Holiday	318	2:46	0	0
Correction of attendance	343	5:20	0	0
TOTAL	784	10:48	123	2:42

Figure 5. Comparison of Power Key application (before and after the change)

The total number of operations (entering in PKW system) decreased from original 784 to 123 operations/month, which decreased time of HR specialists from 10 hours 48 minutes to 2 hours 42 minutes/month.

4.5. Phase Manage/Control

In the final phase it was crucial to prevent a reverse effect and keep the current state. Therefore the HR department accepted these measures:

- random controls done by HR department of correctness of revisions in the attendance evidence,
- realisation of controls by managers and superiors (if errors were corrected within 24 hours),
- weekly control of number of errors in the attendance evidence using statistics Wochenbericht,
- re-training of employees for workflow in case of changes in the module,
- training of new employees how to workflow.

4.6. Project summary, evaluation and its contribution

After the project realisation the company uses a request for days off via workflow. For confirmation or denial of the employee request in the attendance system (PWK) the superior (manager) is responsible. After the request approval of the leave of absence it is automatically recorded in the plan and the attendance system. Errors in the attendance are corrected by the manager (not HR specialist).

The main benefits are the simplification and expediting of the process, cancellation of paper forms, accuracy data for reporting improvement (productivity, overtime), and increase of responsibility of managers for the attendance of their subordinates.

Specifically:

- total number of operations (entered in PWK system) declined from 784 to 123 operations/month,
- time of HR specialists decreased from 10 hours 48 minutes to 2 hours 42 minutes/month
- for the type of data – leave of absence or days off decreased the number of operations from 318 to 0 operations/month, and time of HR specialists from 2 hours 46 minutes to 0 h,
- corrections of the attendance data from 343 to 0 operations/month and time of HR specialists decreased from 5 hours 20 minutes to 0 hours/month.

- total savings represent 661 operations a 8 hours 5 minutes of time of HR specialists (1 working day/month),
- average speed of corrections decreased from original 4 days to 1 day (on pilot departments/working places),
- cancelation of paper forms (3 types of request forms) approx. 330 pieces of printed paper (*2 CZK) 660 CZ/month., 7 920 CZK/year.

CONCLUSIONS

The aim of the paper was to demonstrate a practical use of the lean administration in HR processes. In the first part the objective was to comprehensibly describe the topic of the lean administration and its methods and tools from the theoretical perspective. The second part of the paper showed the practical use of selected tools of the industrial engineering and proved them on the process of improvement. The use of these methods and lean administration tools was demonstrated on the process of the Employee attendance on a case of a chosen company. It was a part of six parallel continuous improvement projects in the period from August till November 2014 in one Czech company in its administration. Within the project there were used methods and tools as DMAIC, SIPOC, Pareto analysis, 5 x WHY, standardisation etc. The application of these methods was transformed into a methodology which can be used for further improvement activities. Lean activities in administrative processes were overall successful. Benefits brought mainly time savings which company can use for further continuous improvement projects.

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REFERENCES

- [ASQ 2017] ASQ. 2017 [online].
Date of Webpage creation/actualization [26.9.2017].
Available from
<http://asq.org/learn-about-quality/six-sigma/overview/dmaic.html>
- [Byfuglien 2012] Byfuglien, J., Torstensen, H. & Trolie, A. The improvement of HR management by using Lean [Online]. Available from
[https://www.unece.org/fileadmin/DAM/stats/documents/ece/ces/ge.54/2012/Norway__Paper_The_improvement_of_HR_mangementv2.pdf](https://www.unece.org/fileadmin/DAM/stats/documents/ece/ces/ge.54/2012/Norway__Paper_The_improvement_of_HR_managementv2.pdf)

- [Dibia 2010] Dibia, I. & Onuh, S. (2010). Lean Revolution and the Human Resource Aspects. London UK: Newswood Limited.
- 2014 Introduce Lean HR Processes [Online]. Available from <http://www.creativehrm.com/lean-hr-processes-introduce.html>
- [Eurostat 2011] Eurostat yearbook: a statistical eye on Europe. Luxembourg: Office for official publications of the European communities, 2011.
- [Hughes 1996] Hughes, G. E. A new introduction to modal logic. New York: Psychology Press, 1996.
- [IJtsma 2014] IJtsma, M. Lean HR. Do more with less and enjoy doing it [Online]. Available from <http://www.culturalchemistry.com/wp-content/uploads/2012/04/Lean-HR.pdf>
- [Juran 1988] Juran, J. M. Juran on planning for quality. New York: Free Press, 1988. ISBN 0-02-916681-0.
- [Pelantova 2016] Pelantova, V. & Slaichova, E. Control of Spare Parts Inventory in Organisations. MM Science Journal. 2016, Vol. 5, issue 11. pp. 1509 – 1514. ISSN 1803-1269. DOI: 10.17973/MMSJ.2016_11_2016170
- [Schonberger 2009] Schonberger, R. (2009). The Human (HR) Side of Lean [Online]. Target, (4). Available from http://www.ame.org/sites/default/files/documents/09-25-04Insights_HR_Lean.pdf
- [Tracey 2006] Tracey, M. & Flinchbaugh, J. (2006). How Human Resource departments can help lean transformations [Online]. Target, 22(3). Retrieved from http://www.leadingedgegroup.com/assets/uploads/How_HR_Helps_Lean.pdf
- [Womack 1996] Womack, J. P., & Jones, D. T. Lean thinking: Banish waste and create wealth in your corporation.

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