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How Lean Management tools are supported by ERP-systems – an overview

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Abstract. An increasing number of ERP providers offer support of Lean Management in their software. As part of a larger research project this article gives an insight which elements of Lean Management are already covered by ERP-systems. More than 150 different functionalities within the ERP-systems have been identified that support Lean Management. Not surprising production planning, scheduling and pull principles are supported by most of the functionalities, followed by performance and visual management. A detailed analysis out of a selection of five ERP-systems showed that they have more than 50% of the functionalities in common. But they are less realized in the basic system but in up to 15 different modules with the focus in production.

Keywords: ERP-system, Lean Management, Lean ERP, Toyota Production System, SAP

1 Introduction

This paper is part of a larger research project that has been outlined by Adam et al. [1]. Its main goal is to foster research in Lean ERP – that is how ERP-systems support Lean principles. The paper mentioned above gives a reasoning of the research and an overview about the market situation. It shows that Lean ERP is a niche market regarding to customer demand. But there are a high number of ERP providers who offer Lean functionalities in their software.

The intention of this paper is to find out which Lean tools are supported by which modules of the ERP-system and to see if there is a difference between the vendors. In order to accomplish this goal an overview of Lean tools is given. In a next step 10 ERP-systems have been selected and functionalities identified that support the Lean tools. Five ERP-systems have then been analyzed in order to see if the functionalities are covered by all vendors.

The evaluation is based on interviews and freely accessible information from the ERP providers. It turned out that the vendors didn't use Lean terminology consistently. Some even introduced their own terms. So linking new terms to the common Lean terminology opens space for misinterpretation. As the interview partners mostly haven't overseen all modules and as there might be material that was

not available for the research team, the result is biased and is not claiming for completeness.

2 Overview of Lean Tools

2.1 Origin

“Lean Management” as a term was introduced by Womack et al. at the MIT in Boston after having studied the Toyota Production System [2]. The TPS consists of a number of techniques that historically have been developed over a period of more than 50 years. Each tool has been an answer to specific problems that have occurred to Toyota whereas the overall goal always was to raise efficiency and reduce cost. This led to the permanent focus on waste reduction. Techniques to identify value add and non-value add activities have been developed. Keeping cost of poor quality low was another important element in saving money. Tools like Standard Operation Procedures (SOP), Total Production Maintenance (TPM) helped to raise reliability in the output of man and machine. Error-proof methods, also called Poke-Yoke have been installed to keep rework low. After stability of the process has been reached, flexibility was another topic. Due to the small automotive market in post-war Japan, batch sizes had to be small and quickly responding to customer wishes was essential. Change over times had to be reduced and techniques like Single Minute Exchange of Dies (SMED) had been introduced. Motivated by Henry Ford, Taiichi Ohno introduced flow production. But contrary to Ford, Ohno raised flexibility by reducing batch sizes until the ideal of a single piece flow. Another instrument to reduce cost, that have been caused by excessive inventory was the use of supermarkets and Kanban. Downstream processes withdraw material when they need it and in the right quantity just-in-time by using Kanban cards. No management effort is needed. Beside of all the new tools a main goal was to enable people to make their own work environment more efficient e.g. by Kaizen events [3][4].

2.2 Lean Tools

Although the evolution of the TPS was the answer to specific problems, the implementation of the tools followed certain logic. Identify customer requirements stands at the beginning and is followed by permanent waste reduction. Error-free and stable processes are prerequisites to gain flexibility. Whereas Kanban requires stability and flow to work properly. This logic is covered by the five Lean principles of Womack and Jones that guide implementation: Value -> Value Stream -> Flow -> Pull -> Perfection [5].

Based on Ohno, Shingo and Womack an overview of Lean tools has been developed, in order to assess ERP support. The list follows the logic of the five principles (see Fig. 1).

Lean tool - Level 0	Related functionalities - Level 1
Value Stream Analysis	Modeling Capability
Waste Analysis	Documentation of rework activities
Total Productive Maintenance (TPM)	Documentation of preventive activities
Standard operation procedures (SOP)	Documentation of operational method sheets
Quality at the source (Poka Yoke)	Documentation of mistake proofing efforts
Performance Management	Tracking and reporting functions
Visual Management	Visual Controls (Dashboards, Cockpits)
	Andon line
	Kanban Visualization (Track Kanban)
	Exception Alerts
Single Minute Exchange of dies (SMED)	Tracking functions
Production Planning	Demand Calculation
	Takt time calculation
	Safety & Buffer Planning (Inventory / Supermarket)
	Production Strategies
	Material Resource Planning (ABC, XYZ analysis)
	Cellularization (Plant Design, Line Design, Cell design)
Production Scheduling	Mixed production scheduling / Sequencing (Heijunka)
	Pacemaker Planning
	Capacity balancing of line
	Batch Size Optimization
	Back flushing capabilities
	Production simulation capabilities
Continuous flow	Standardization
	JIT
Generic Pull System (Kanban)	Pull signal creation
	Pull signal distribution (e.g. Electronic Kanban)
	External Kanban
Continuous Improvement	Kaizen

Fig 1.: Overview of Lean tools on two levels

3 Assessment of ERP-systems

3.1 Lean tool support by ERP-systems

In the next step a selected number of ERP-systems have been assessed against the list of tools in order to augment the related functionalities to a third level. The goal was to find out, which functions have been already realized in ERP-systems. Therefore a broad range of ERP-systems have been analyzed, from niche products to market leader. A criterion was that the vendor has announced a support of Lean Management and that information was available for public. The following vendors have been in focus: SAP, IFS, Microsoft AX, Infor, Plex, QAD, Seradex, Ultriva, SSL WinMan, IQMS.

At the end more than 150 distinct functionalities have been identified that support the Lean tools. The list of tools could be extended with these functions to a third level. Not surprisingly more than 40% of the 150 functions support Production Planning and Scheduling. Already far behind are functions that support Kanban, Performance and Visual Management. They contribute to the 150 functions with around 10% each (see Fig. 2).

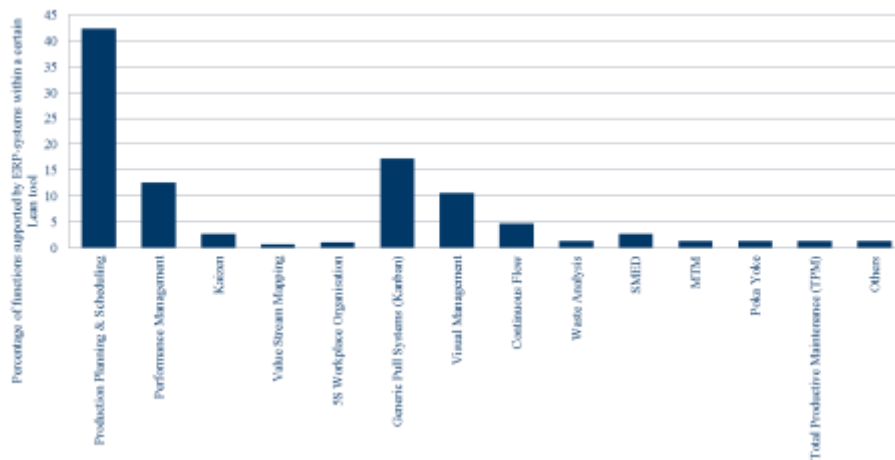


Fig. 2: Percentage of functionalities that are supported by ERP-systems within a Lean Tool

These findings have been compared with a survey about the usage of Lean tools in 80 large and mid-size companies in Switzerland. Among the most frequently applied tools are Kaizen, Value Stream Analysis, 5S and Kanban (see Fig. 3) [6].

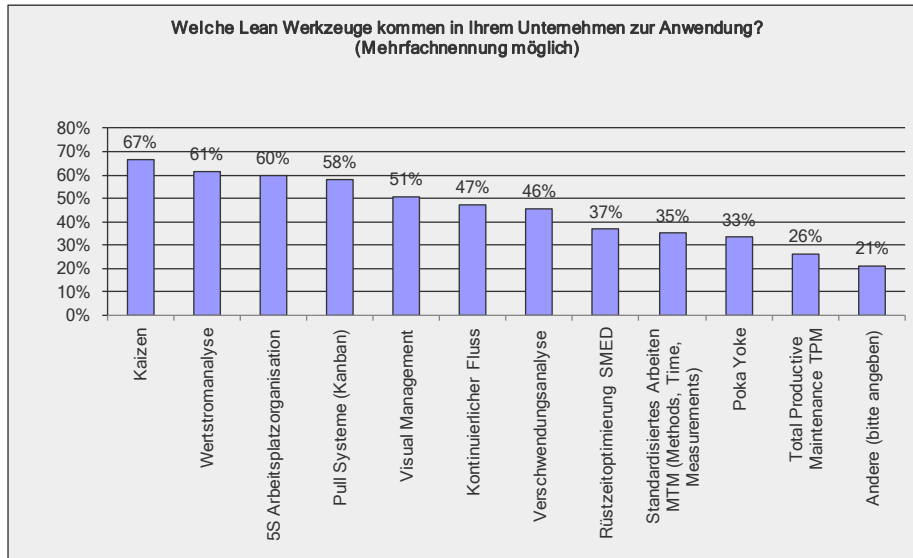


Fig. 3: Usage of Lean Tools in Swiss large and mid-size companies

If we compare the results of the two studies we see that e.g. for Kaizen, which is the most frequently used tool, hardly any support functions are developed in the ERP-systems. Similar results are for Value Stream Analysis and 5S. Another finding shows that from Kanban onwards in figure 3, the usage of the tools correlates with the number of support functions realized in the ERP-systems. That might lead to the interpretation that the software has been developed according to customer demand.

3.2 Comparison of ERP-tools

After having identified 150 functionalities in the ERP-systems that support Lean tools, the next question to ask was, are there any differences between the systems. Five systems out of the ten have been assessed in detail: SAP, Microsoft AX, IFS, Plex, QAD. The selection was based on the intention to cover the entire range: established vendors and new ones, large and small ones, those with a broad set of functionalities and specialized ones.

The result shows that the functionalities realized in the systems are quite similar. Although using different terms, SAP, IFS, Plex and QAD covered most of the 150 Lean functionalities, whereas Microsoft AX was following closely. Comparing the functions that are supported we see that the five vendors have nearly 50% of the functions in common. Among the 14% that are only covered by one vendor are certain type of Kaizen support and Value Stream Analysis. This goes in line with Fig. 2 where Kaizen and Value Stream Analysis is among the ones with less support in the ERP-systems (see Fig. 4).

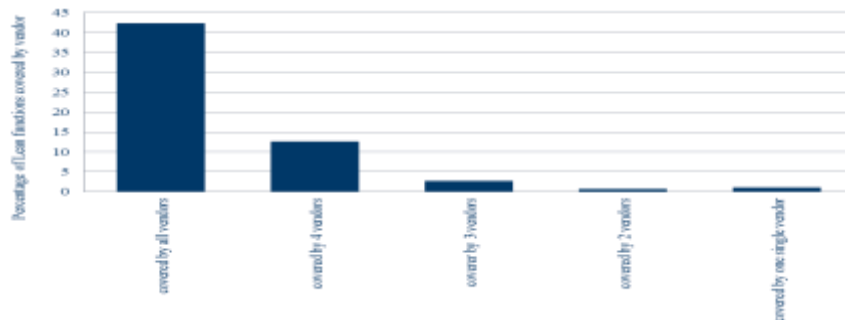


Fig. 4: Coverage of Lean functionality by SAP, IFS, AX, Plex, QAD

In most of the cases the functions don't sit in the basic ERP-system but are spread over many modules. For SAP more than 15 different modules and linked products have been found that support Lean. The main ones have been SAP Manufacturing Integration & Intelligence and Manufacturing Execution. A similar situation is given in the example of IFS and QAD. Twelve and eight modules in the case of QAD contain the Lean support, mainly the ones for manufacturing. This shows that especially in the case of SAP and IFS the original ERP-system has either be augmented by Lean functions, like pull production, or new modules have been developed, like the IFS Kanban. This has been done either internally or by acquiring external companies.

4 Conclusion and further research

Beside the fact that the results are biased due to company-specific terminology and lack of access to all relevant product information, the research showed the astonishing number of more than 150 functionalities that support Lean tools in ERP-systems. It also found out that they mostly support production planning and scheduling followed by Kanban and visual management. A detailed analysis of five ERP-systems showed that they have realized quite the same functions. But that they are spread over up to more than 15 different modules. Further research should drill into one ERP-system and cope with topics like modification in case of introduction of Lean Management and the development of an implementation roadmap.

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