Lean ERP –how ERP-systems and Lean Management fit together

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Abstract. Lean Management and ERP-systems are seen as contradicting each other. Lean Management goes for low cost automation, simplicity and high visibility of information flow whereas ERP-systems might become complex and intransparent. This article outlines a research project that combines pros of both. This is called Lean ERP. First results of a study showed that it really is a niche market while a surprisingly high number of ERP providers already offer Lean support in their software.

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

1   Introduction

1.1   Lean Management and its cons

Lean Management has its origin in the Toyota Production System (TPS). TPS is a management philosophy that includes the entire organization – people, culture, processes. Its first elements go back to the 1920´s and where meant to fix cost problems when Toyota was still a loom company. Further elements were developed by Taiichi Ohno to cope with new challenges concerning flexibility in the 1950s. Low costs, high flexibility and quality lead to profitability which is the ultimate goal of TPS. Costs are reduced by eliminating waste, demand-driven planning and balanced processes. Small batch sizes reduce lead time and drive flexibility. Enabling employees and customer orientation help to reach quality [1]. "Lean Management" as a term was introduced by Womack et al. in the 1990´s at the MIT in Boston after having studied the TPS [2].

Lean Management nowadays is widely applied in the automotive industry. It also became popular in other industries, even in services. New terms like Lean Accounting, Lean Office or Lean IT demonstrate its popularity. Nevertheless, cons were expressed that will be discussed in the following [3]. As excessive inventory raises costs and huge batch sizes lowers flexibility, Lean Management goes for short planning horizons and produces only according to customer demand. By nature Lean is reaction-based as it does not consider forecast. Lean is more tactical and job-floor

oriented than strategic. This might be a problem for companies with long production cycles or for companies that rely on high demand components with long order lead times.

Ideally, production is balanced and the product flows without interruption from one step to the other. If cycle times of the process steps vary too much, balancing is not possible and Kanban signals are used to pull from downstream. The most downstream process step triggers the entire production line. This simplifies planning a lot as only one step in the entire production lines needs to be scheduled. As Supply Chain Management becomes more integrated, critics argue that physical Kanban signals cannot move out of the plant to suppliers. This might also be a problem in case of multisite companies.

Data handling engenders criticism as well. A core element in Lean is Visual Management. Current performance data are displayed on the job floor to everybody. Employees and management see at a glance if the process is in or out of control. Correction actions can be taken immediately. Therefore current performance data are needed. Critics argue that without adequate IT support, data gathering, formatting and displaying might become exhaustive and lead to errors.

1.2   ERP-systems and its cons

Similar to Lean Management, "Enterprise Resource Planning Systems" (ERP) also face its challenges. ERP started from simple Material Requirements Planning Systems (MRP) and moved into all aspects of a company including its relationship with suppliers and even customers. Functionality grows and with it ERP are getting complex. Visibility of processes gets lost.

ERP provide workflows for business processes that are often best practice. On the one hand, companies may reach a better level of process support by implementing ERP. On the other hand, this promotes inflexibility as the processes are hard coded and modification is mostly limited by the companies to a minimum in order to avoid additional costs.

One big advantage of ERP is data handling. All relevant data are inside the ERP database. Decomposing bills of material, analyzing component order lead times, calculating takt, timing and sequencing orders is done automatically. On the other hand, data are often average and variation is not considered. Job floor scheduling ignores real demand and central steering does not react properly to unplanned incidents like broken die.

1.3   Lean Management versus ERP-systems

Lean Management and high cost automation are often seen as contradictory [4]. This also applies to IT support. Lean advocates argue that IT leads to intransparency

of the process flow as visibility is lost. Job floor employees no longer see the information flow. They cannot react immediately if something happens, like postponing material replenishment due to longer change over times, as everything is preplanned and steered centrally by some computers. In that case, IT diminishes the problem solving ability of a single worker just where continuous improvement is essential to Lean. Companies often move towards Lean Management as a response to the complexities and intransparency brought in by IT. So, typically, the Lean advocates resist using IT until lean principles are implemented manually [5].

Nevertheless, IT systems are heavily used in most of the companies. 92% of the companies use ERP [6]. So, whenever, a company moves toward Lean Management, and as we have noticed, a growing number of companies does this, there are always discussions of pros and cons of ERP. Sometimes they follow more the ideological path than the rational. Sometimes simple questions occur like, how much "pull" is needed? Do we still need our push signals from ERP or do we rely purely on paper based pull signals from downstream? Shall we skip forecasting and rely entirely on current demand? These are the kind of questions that laid the ground for the following research.

1.4   Lean Management and ERP-systems

Having highlighted some of the challenges that Lean Management and ERP face today, we argue that both complement each other well. As discussed before, Lean Management has its pros in demand driveness and its short comings in forecasting and coping with long ordering lead times. As far as ERP is concerned it is not able to handle unplanned situations on the job floor. Combining both ERP forecasting functions, including decompositions of complex bills of material with Lean pull job scheduling might help [7].

One main reason why ERP is implemented is accurate real time reporting. This is exactly what Lean needs for its continuous improvement principle: accurate data of current performance with high visibility to those who are concerned. Without a single database, dedicated data entry points and analyzing and displaying functions as it is offered by ERP and Business Intelligence systems this might become time consuming and error prone. ERP can make these processes less labor intensive and provide visibility to performance, error handling, job status and inventory more easily [8].

So this is what we call Lean ERP: ERP-systems that support Lean principles.

2   Spread of Lean ERP

In a recent study conducted by the University of Applied Science in Kufstein / Tyrol 21 out of 35 ERP software producers reported that their systems offered some sort of Lean Management support. This is an amazing number. These functions have been developed in the last 2-4 years. Consequently, supporting Lean principles within

ERP are quite a new phenomenon. Software producers that are new in business and those that are well-established offer more Lean support than others. The new and small companies often built their ERP on the base of Lean principles and found a new niche. Whereas the established ones, like SAP, Oracle or Infor, augmented their existing wide range of functionalities with Lean support.

Whether an ERP-system has implemented Lean functions or not also depends on the industry, e.g. ERP for the construction branch have less Lean support. The more international the users of an ERP-system are, the more they use ERP with Lean functionalities. ERP support Lean principles mainly in their material management, production and sales modules. This is not surprising, as this is where Lean comes from and where Lean is mostly applied. Interestingly most of the ERP producers do not plan to further develop into Lean as customer demand is low.

This leads us to the second part of the study. Although many software providers offer Lean functionalities in their systems only 4 out of 80 companies are using them. This means that it is really a niche market. As stated above, Lean advocates are ambiguous about IT support, this has also be proven in the study: companies who go for Lean do not automatically use Lean ERP. They often modify functionalities in their classical ERP-systems and they don't buy specific Lean ERP software. On the other hand, if an ERP system offers Lean support, companies are likely to use them. The use of Lean ERP systems depends of the size of the company, showing that mid-size companies are more ahead than small or large ones.

3   Areas of research in Lean ERP

We found that Lean Management and ERP-systems is not a question of one or the other but that they might fit together. We have identified fives areas of interest for further research (see Fig. 1).
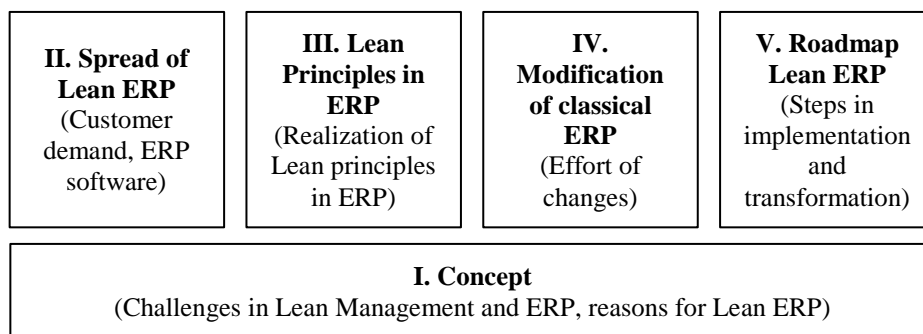
II. Spread of Lean ERP (Customer demand, ERP software)	**III. Lean Principles in ERP** (Realization of Lean principles in ERP)	**IV. Modification of classical ERP** (Effort of changes)	**V. Roadmap Lean ERP** (Steps in implementation and transformation)

I. Concept (Challenges in Lean Management and ERP, reasons for Lean ERP)

Fig 1. Areas of research in Lean ERP

A first comparison of the Toyota Production System and a modern ERP-system showed the following differences (see Fig. 2.).

Categories:	Toyota Production System	Modern ERP
Motivation	Raise profit by flexibility & quality (e.g. elimination of waste, demand-driven planning, balanced processes, continuous improvement)	Get better information and higher productivity by automation of processes and integration of functions
Orientation	Optimization of single business processes	Integration of all business processes
Tools	• Low cost automation • Visualisation	• IT- support • Digitalisation
Production strategy	• Continuous flow & Pull – System • Shopfloor orientation • Mainly „Bottom-up"	• Push – System • Management orientation • Mainly „Top-down"& partly „Bottom-up"
Planning / Scheduling / Controlling	• Local • In-house view • Short-term planning (demand driven) • Small batch sizes • Physical Pull signals (Kanban)	• Centralized • In-house & cross-company view • Long-term (forecast) & short-term planning • Large batch size • Electronic central steering

Fig 2. Differences between the Toyota Production System and ERP-systems

The comparison shows that most modern ERP-systems follow a philosophy that emphasizes on large-scale production and full load of machinery. This is contrary to the Lean principles.

4   Conclusion and Further Research

In this paper we have outlined that Lean Management and ERP-systems are seen as contradicting each other. On the one hand, modern ERP-systems implemented a production system that focuses more on equipment efficiency than on demand flexibility. On the other hand, Lean advocates have their doubts about the intransparency and complexity of fully IT-automated processes. Nevertheless, most of the companies have implemented ERP-systems in order to overcome some of the cons of Lean Management. This is the motivation of a research project which looks for opportunities to combine both, Lean Management and ERP-Systems. This is called Lean ERP. First results of a study showed that Lean ERP really is a niche market while a surprisingly high number of ERP providers already offer Lean support in their software. Further areas of research were, like the realization of Lean principles in ERP-systems, the modification of classical ERP towards Lean or a roadmap for Lean ERP.

5   References

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