From Paper Chaos to Digital Control: A Lean Administration Case Study

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Abstract

This paper investigates the fusion of Lean Administration (LA) and Digital Transformation (DT) within Small and Medium-sized Enterprises (SMEs), addressing a research gap. A detailed case study of a German SME's Accounts Payable (AP) process reveals initial challenges and promising prospects. Findings highlight the role of LA in driving DT, offering insights into process optimization and digital readiness. Despite initial limitations, LA principles show potential for sustainable improvements. The study's contributions extend to guiding SMEs in their DT journey, offering a structured framework for efficiency enhancement and compliance.

Keywords: Lean Administration, Small and Medium-sized Enterprises, Digital Transformation

Introduction

In today's rapidly evolving business landscape, companies of all sizes recognize the imperative need to embrace Digital Transformation (DT) to remain competitive and efficient (van Veldhoven and Vanthienen, 2022). Especially administrative tasks remain still manual. Lean Administration (LA) is a fundamental concept that simplifies business processes and administrative procedures to complete office tasks more efficiently and without waste. LA thus decisively combats bureaucracy in companies and public authorities (Wunderlich et al., 2023). Some studies have addressed LA and DT (Kieviet, 2019; Romero et al., 2019; Wijnhoven et al., 2016). However, the combination of both has not been studied within Small and Medium-sized Enterprises (SMEs). Therefore, this study addresses the following research question:

RQ1: How does Lean Administration drive Digital Transformation within SMEs?

RQ2: How can the Lean Administration approach help to prepare and implement a digitalization initiative for a central business process if little digitalization know-how is available?

This paper is dedicated to showing the role of LA in driving DT within SMEs. This includes intensive elaboration of the process using the DMAIC methodology (Dahm and Haindl, 2015). Based on the goals of increasing process efficiency, improving process quality, and complying with the future EU e-invoicing regulations (Kandlhofer, 2022),

this study highlights the importance of LA as a catalyst for DT in the context of Accounts Payable (AP) within a case study.

The initial analysis showed that the average processing time for approx. 1250 monthly invoices is 16 days, an invoice travels about 140 meters through the office, and large creditors are no longer willing to send their invoices by post. This underlines the relevance of the digitization offensive. This research gives implications and generalized recommendations for mainly decision-makers and implementers in small and medium-sized companies in a similar situation. These insights could also be transferable to other areas.

Invoice Processing and Accounts Payable

Typically, invoice verification involves thorough examination upon receipt to ensure alignment with orders and delivery documents. Upon successful reconciliation, a payment document is generated. However, supplier disruptions may occur due to high volumes, such as invoicing for unordered or incorrectly ordered goods or goods delivered in inadequate quantities or with defects. Hence, pre-payment validation is necessary to mitigate these risks (Grimm-Curtius and Duchscherer, 2000).

The explanations elaborate on credit accounting in general and under German legal provisions. According to §14(1) of the German Value Added Tax Act (Bunjes et al., 2021) an invoice is any document used to settle a transaction for goods or services, irrespective of its terminology in business dealings. Moreover, invoices must be transmitted in either paper or electronic format, contingent upon the recipient's approval (Bunjes et al., 2021).

The effective functioning of AP and accounting processes relies heavily on the process management and flow of information through various phases, from document creation to final filing. According to Grimm-Curtius & Duchscherer (2000), the AP process can be delineated into three main phases: Document Preparation, Document Posting, and Document Monitoring. In the Document Preparation phase, documents are meticulously created, numbered, and protected against loss or unauthorized issuance. Subsequently, in the Document Posting phase, these documents are entered into the accounting system and annotated for verification before filing. Finally, in the Document Monitoring phase, internal or external audits are conducted to ensure the integrity of the document system and identify any irregularities (Grimm-Curtius and Duchscherer, 2000).

Moreover, legal requirements, such as those stipulated by the German Value Added Tax Act (UStG), mandate specific information to be included in invoices for their legal validity. As outlined by Bunjes et al. (2021), invoices must contain details such as full names and addresses of both the performing entrepreneur and the service recipient, VAT identification numbers, invoice dates, unique invoice numbers, item descriptions, quantities, prices, tax rates, and payment terms. These details are checked in the verification process (Dennerlein, 2022).

Furthermore, legal regulations dictate the archiving requirements for invoices and receipts to ensure transparency, compliance, and readiness for tax or legal audits. Dennerlein (2022) outlines specific retention periods and archival practices mandated by the German Commercial Code (HGB) for various types of documents, emphasizing the importance of compliance to avoid legal consequences (Dennerlein, 2022).

Due to various EU regulations and country adjustments, electronic invoicing will be mandatory in the next year (European Commission. Directorate General for Taxation and Customs Union. et al., 2022; Kandlhofer, 2022).

The advancement of digitalization offers opportunities to optimize AP processes by leveraging technologies such as Workflow Management Systems (WMS) and Robotic Process Automation (RPA). Dennerlein (2022) highlights the potential benefits of

integrating WMS for streamlining invoice processing, while Bahaweres et al. (2022) demonstrate the efficiency gains achievable through RPA implementation in purchase-to-pay processes (Bahaweres et al., 2022). Cuylen et al. (2016) present the Electronic Invoice Processes Maturity Model (EIPMM), an eight-stage framework designed to improve electronic invoicing processes. This model addresses technology, processes, organization, acceptance, and strategy, providing companies with a systematic approach to assessing, optimizing, and implementing e-invoice processes (Cuylen et al., 2016).

Lean Six Sigma and Lean Administration

Lean Management focuses on reducing waste and increasing efficiency across processes, not just in production but also in business processes. Lean Administration describes the transfer of Lean Management principles to administrative processes. Involving employees in the improvement process is central to achieving transparency, acceptance, and deeper insights (Dahm and Brückner, 2014; Bertagnolli, 2020). On the other hand, Six Sigma primarily targets improving product and process quality through structured methodologies and statistical techniques (Dahm and Brückner, 2014; Koch, 2015; Linderman et al., 2003). Combining both approaches, Lean Six Sigma (LSS), results in improved value creation and efficiency (Töpfer, 2009). While Six Sigma enhances process capability, Lean Management focuses on creating flow and reducing waste (Töpfer, 2009). In practice, Six Sigma projects follow a defined process (DMAIC cycle), while Lean Management allows more freedom and faster implementation of improvements (Dahm and Brückner, 2014).

The DMAIC cycle starts with the define phase. The define phase deals with defining the problem domain, the project goals, the scope, the performance metrics to be tracked, the project personnel resources, the timeline, and other essential resources (Bornhöft and Coners, 2012).

The measure phase aims to thoroughly understand the process's current state (Georg, 2015). The goal is to determine the current level of achievement of the process under optimization in meeting customer and stakeholder requirements. This assessment is based on process-related data. Ensuring data quality is also a priority (Bornhöft and Coners, 2012).

The analyze phase is a critical core component of a DMAIC project (Bornhöft and Faulhaber, 2007). The analyze phase aims to answer the question of the problem's core causes and why the current process cannot meet customer and business requirements. Hypotheses are made about the causes to check them using analysis tools. The before-collected data is analyzed using statistical and qualitative tools. After this phase, the findings regarding the key influencing factors (X) on the issue at hand (Y) are summarized in a list format and substantiated with facts (Bornhöft and Coners, 2012). This list documents potential causes with figures, data, and facts. These insights provide a basis for a reliable decision regarding improvements for the next phase (Meran et al. 2014).

In the improve phase, proposed solutions are developed to eliminate the causes of the problems identified in the analyze phase. Alternative courses of action are developed and evaluated (Bornhöft and Coners, 2012). It answers the question of the best solutions for eliminating the core causes of the problem of the focus. Solutions are created, refined, filtered, finalized, and then implemented process (Meran et al., 2014).

In the control phase, whether the project was successful or not is verified. The benefit calculation is also revised, and the process is handed over to the process owners (Dahm and Brückner, 2014). The control phase aims to ensure the improvement's sustainability by answering the question of how the improvement is measured, verified, and integrated

into the existing or future process control. The knowledge gained is guaranteed by transparent and understandable project documentation for other teams. Sustainability in this context means that the improvement is achieved not only through successfully implementing solutions in the process but also through changes in the behavior of those involved (Meran et al., 2014).

Research Design

This study employs a multifaceted approach to investigating the fusion of LA and DT in SMEs. The central focus is a real-world case study (Yin, 2013) within a German SME, which provides detailed insights into the practical application of LA principles in optimizing AP processes while driving DT.

The case company is committed to driving digital transformation within its operations. However, despite its enthusiasm for digitalization, it faces a significant challenge: a lack of resources and expertise to effectively and efficiently execute its digitalization initiatives. One process plaguing the company is the AP invoice verification process. This process, which involves pre-allocation and verifying invoices against purchase orders and receipts, is known for its manual and paper-based nature (Osterhage, 2014).

Data collection involved interviews, observations of AP execution, and document analysis, ensuring a comprehensive understanding of the initial process and its potential. The company was accompanied throughout approx. nine months in 2023. An overview of all the data collected is given in the following table.

Table 1 – Interviews and Communication

Description	**Quantity**	**Duration**
Emails received	105	-
Emails sent	102	-
Compared digitalization offers	12	-
Onsite visits	5	-
External presentation meetings	11	602 mins
Telephone calls	16	91 mins
Internal workshops	6	304 mins
Formal Interviews	5	239 mins

The Lean Six Sigma DMAIC framework guided the process optimization efforts, helping identify bottlenecks, measure process performance metrics, analyze root causes, implement improvements, and establish control mechanisms (Linderman et al., 2003). The aim was to integrate employees as closely as possible into the improvement process using the DMAIC method and the structured application of various tools.

Findings

The study reveals significant findings that shed light on the interplay between LA and DT. The study begins with the define phase. In the define phase, a project charter was drawn up, the project framework was defined, objectives were set, the rough process was recorded in the form of a SIPOC (Bornhöft and Coners, 2012) and the internal and external customer requirements were recorded. The six main steps in the process are invoice receipt & and forwarding, invoice auditing, approval, entering, and the payment course and the archiving of the invoices. The process starts with receiving the invoice from the supplier or service provider. The study identified inherent challenges in the use

case: Employees must sift through stacks of paper invoices (approx. 1250 per month), manually input data to the ERP system, and reconcile discrepancies – a time-consuming and error-prone task. Most of these invoices arrive physically and are processed manually and non-digitally. Some suppliers prefer sending invoices via email due to their strong market position (e.g., Telekom), eliminating the need for postal delivery. However, these email invoices must be printed for processing within the current workflow.
Additionally, the departure of a central accounting employee at the beginning of the year has intensified the project's urgency because most of the process knowledge was lost. After all, only a few parts were roughly documented. Furthermore, the absence of digitalization exacerbates the problem, making subsequent document retrieval, such as for financial audits, complex and time-intensive.

In addition to applying the tools described, the EIPMM by Cuylen et. al (2016) was also considered. The company is still in the early stages of its DT journey, reflecting the low maturity level, mainly on the initial level (Cuylen et al., 2016). The aim is to take the process to the next level. The company remained additionally unprepared for extensive and innovative solutions, as evidenced by its rejection of e.g. Robotic Process Automation (RPA) as an efficiency-enhancing tool (van der Aalst et al., 2018).

This project collects reliable data on aspects such as lead times, process quality, and costs. This data enables the team to comprehend the root cause of the problem. In the project, a definition of the key figures was created, the data was collected, the actual process was recorded, and the DPMO (Defects per Million Opportunities) was calculated (Allweyer, 2016; Bornhöft and Coners, 2012; Bornhöft and Faulhaber, 2007; Georg, 2015; Meran et al., 2014). The measurements show that an invoice takes an average of 16.5 days from receipt to payment. In the sample, around 10% of invoices fail to meet the payment deadline, resulting in a process quality of 90.16% and a process sigma of 2.8 (Georgii, 2015).

In the next phase of the project, data analysis and research into the core problems of the inefficient process was carried out together with the company's employees. The central question was the search for waste in the process. Lean Six Sigma categorizes processes into value-adding, non-value-adding, and value-supporting elements. In the analysis phase, the process is examined for various types of waste. This includes extra transportation, rework, waiting times, excessive processing, overproduction, inventory, extra movement, and waste of intellectual capital due to over/underutilization (Bornhöft and Coners, 2012). The waste analysis conducted revealed several core causes within the process. Firstly, it was observed that physical invoices need to be transported multiple times between workstations, resulting in significant processing delays. Additionally, the accumulation of mail at various points throughout the process chain leads to inefficiencies and prevents the establishment of a one-piece flow. Another notable issue is the unnecessary movement of employees within the office, primarily due to the handling of both physical and digital invoices. However, the most significant waste identified is waiting time, which occurs at various stages of the process. Delays in invoice arrival, unpacking, distribution, sorting, approval, and payment contribute to prolonged throughput times. Furthermore, overproduction and overprocessing were identified as additional sources of waste, highlighting the need for optimization and questioning the necessity of certain approval procedures. The lack of digitization emerged as a central cause of inefficiency, with the absence of digital storage systems and automated processes exacerbating processing times. Digitization could significantly streamline operations and reduce manual tasks, thus addressing several inefficiencies within the process. Lastly, the under-utilization of employees was noted, with staff often performing tasks below their qualifications. Optimizing the process could free up employee capacity for more complex

activities, enhancing overall efficiency. Interview reports underscored the need to reallocate employee resources to focus on more demanding tasks within the company's financial accounting department.

Based on these findings, the transport routes of the invoice were analyzed in more detail. A spaghetti diagram was created for this purpose (Meran et al., 2014). An invoice travels an average of 140 meters through the company building. In summary, it became clear that the lack of digitization of the process and the associated analog transfer of documents is the leading cause of the inefficiencies. In addition, waste was identified as having unclear responsibilities and non-value-adding activities. The structured approach and the recording of the results created transparency for the existing problem and created a common understanding among all those involved.

In the improve phase, various possible solutions were weighed up and tested, and a to-be process was created where most of the wasteful and non-value-adding activities were eliminated. The tool comparison included self-developed RPA solutions or workflow functions in the company's ERP system. The former was rejected due to a "lack of willingness to experiment" despite the lower financial outlay. The solution in the company's own ERP system was also rejected because the current release of the ERP system in the company is very outdated and so many needed functionalities are no longer supported or are not even available. For this reason, it was decided to look for a solution that focuses on invoice approval and document archiving and offers an interface to the ERP system. To this end, requirements for the solution were developed together with the commercial director, the financial accounting employees, the IT administrator, and other stakeholders. The decision criteria were formalized and weighted, and then various providers were evaluated. From this, a decision template was developed for the management. This was subsequently accepted. The solution aims to reduce the throughput time to an average of four days and reduce the transport route to 0m, thanks to end-to-end digitalization. In addition, employee satisfaction is increased because various process participants have been relieved of their repetitive and non-value-adding activities and can now turn their attention to value-adding and more complex activities. Finally, the knowledge was transferred in the control phase, and the sustainability and the next steps were determined. Further digitization has already been planned using a similar procedure.

Generalized Recommendations

Based on the project and findings, three main generalized recommendations were derived for practitioners and researchers:

Involving Employees in Improvement Initiatives

To maximize the effectiveness of LA in driving DT within SMEs, it is crucial to involve employees in improvement initiatives. This can be achieved through a combination of top-down and bottom-up approaches, ensuring transparency and fostering a culture of continuous improvement throughout the organization. Top-down leadership involvement is essential for providing direction, setting goals, and allocating resources for improvement projects. Leadership should communicate the importance of DT and LA initiatives to employees, emphasizing the benefits and encouraging participation. Additionally, leadership should empower employees by delegating decision-making authority to support implementing improvements and giving ideas. At the same time, bottom-up involvement is vital for tapping into frontline employees' knowledge and expertise. Employees directly involved in the day-to-day operations often have valuable insights into process inefficiencies and opportunities for improvement. Therefore,

creating channels for employee feedback, such as suggestion boxes, team meetings, or improvement workshops, is essential for soliciting input and ideas from those on the front lines.

Use External Motivation to Gain Internal Momentum
In the initial stages of implementing LA principles and driving DT, SMEs may face challenges such as limited resources, expertise, and resistance to change. However, external pressures, such as regulatory requirements or market demands, can be powerful motivators to kickstart the digital journey and gain internal momentum within the organization. For instance, the impending EU e-invoicing regulations, as well as the market trend towards digitalization, can create a sense of urgency for SMEs to embrace DT initiatives. By leveraging external motivations, organizations can rally internal support and commitment to implementing LA principles and digital tools. Once the initial momentum is established, it is essential to sustain it by fostering a culture of continuous improvement and innovation. The lean culture can help here. This involves celebrating small wins, recognizing employees' contributions, and providing ongoing training and support for digital initiatives. Ultimately, by harnessing external motivations to gain internal momentum, SMEs can accelerate their digital transformation journey and realize sustainable process improvements across the organization.

Guided Framework and Selection of Tools as a Blueprint for the Digitalization Journey
Navigating the complex landscape of digitalization can be daunting for SMEs, especially those with limited digitalization know-how. To facilitate the process and provide a clear roadmap, organizations can benefit from adopting a guided framework and carefully selecting digital tools tailored to their specific needs and objectives. A guided framework, such as the Lean Six Sigma DMAIC cycle, offers a structured approach for identifying, analyzing, and implementing process improvements. By following this framework, organizations can systematically address inefficiencies, reduce waste, and enhance process quality. In addition to the framework, selecting the right digital tools is essential for driving DT effectively. SMEs should conduct a thorough assessment of their current processes, identify areas for improvement, and evaluate available digital solutions that align with their goals. By adopting a guided framework and carefully selecting digital tools, SMEs can establish a clear path for their digitalization journey, overcome obstacles, and achieve sustainable process improvements. This approach provides a first blueprint for success and sets the stage for continued innovation and growth in the digital age.

Implications and Limitations
This study holds substantial relevance in SMEs undergoing DT and gives guidelines on reaching DT with LA. Further, the research offers a nuanced understanding of how LA principles and DT intersect, providing insights into overcoming initial digitalization challenges. The findings from this study serve as a valuable reference point for SMEs embarking on similar digital journeys, helping them anticipate hurdles and adopt LA strategies. Ultimately, this research equips SMEs with a structured roadmap for enhancing little optimized and digitalized processes' efficiency and quality, fostering a culture of continuous improvement while complying with evolving regulations and internal and external pressures. The generalized recommendations can be applied to other processes in the area of business process automation and digitization. Furthermore, the study's contribution extends to the broader academic literature on DT, the discourse on the digitalization of SMEs, and the integration of LA principles.

Several limitations should be acknowledged regarding this study. Firstly, the focus on a highly specialized process, namely invoice approval, may limit the generalizability of the findings to other organizational contexts or industries. Additionally, the study primarily focuses on the German legal framework, although broader EU regulations influence it. Therefore, the applicability of the recommendations may vary in different legal environments. Furthermore, the study primarily examines the digitalization initiative's preparation, optimization, and partial implementation phases, lacking a comprehensive evaluation of long-term sustainability and impact. Moreover, as a single case study, the findings may not be broadly generalizable, and further validation through additional case studies or research is warranted to enhance their validity and applicability across diverse SME settings. Future research will fill some of these gaps.

Conclusion

In conclusion, this case study represents a significant step toward understanding the fusion of LA and DT within Small and Medium-sized Enterprises (SMEs). By delving into the intricacies of a German SME's AP process, the study uncovers initial hurdles and promising avenues for improvement. The findings underscore the pivotal role of LA in propelling DT, offering valuable insights into process optimization and digital preparedness. Despite initial constraints, LA principles exhibit the potential for fostering sustainable enhancements. The study's contributions extend beyond the case company, providing SMEs with a structured framework for efficiency augmentation and regulatory compliance. Future research endeavors will concentrate on additional digitalization projects within the case company, observing the transition of project leadership to internal teams. Furthermore, exploring similar AP process optimizations in SMEs with varying levels of digital maturity will offer insights into the approach's adaptability. Particularly intriguing is the exploration of no-code and low-code technologies, such as RPA, Process Mining, and Artificial Intelligence, and their potential contributions to expediting DT acceptance. This study lays a foundation for further research in LA and DT, particularly within the SME landscape, guiding future endeavors toward sustainable digitalization and process optimization.

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