

See discussions, stats, and author profiles for this publication at: <https://www.researchgate.net/publication/336640974>

How to Improve Shop Floor Management

Conference Paper · October 2019

CITATIONS

0

READS

1,767

4 authors, including:



Sven Hinrichsen

Technische Hochschule Ostwestfalen-Lippe University of Applied Sciences and Arts

76 PUBLICATIONS 164 CITATIONS

SEE PROFILE

Some of the authors of this publication are also working on these related projects:



Assistance systems for manual assembly [View project](#)



Montexas4.0 [View project](#)

HOW TO IMPROVE SHOP FLOOR MANAGEMENT

L. Materna, S. Hinrichsen, B. Adrian, A. Schulz

Industrial Engineering Laboratory,
OWL University of Applied Sciences and Arts, Lemgo, Germany

Abstract

Shop floor management is an important component of the Toyota Production System. The main task of shop floor management is to sustainably increase efficiency and quality in production. The objective of this paper is to identify potentials for improvement of shop floor management in the context of digitalization and to identify fields of action. As a result, the paper will show that insufficiently designed business processes, in particular, lead to additional administrative work for managers. Therefore, optimizing processes can also be seen as a key to giving managers more time for real management tasks. In addition, shop floor management can be strengthened by improving e-mail communication and meeting organization practices, as well as by making reporting more automated and more user-friendly.

Keywords:

Shop floor management, Leadership, Digitalization

1 INTRODUCTION

Shop floor management is a management concept applied in production [1]. The main task of shop floor management is to sustainably increase efficiency and quality in production [2]. In order to consistently pursue this objective, managers must actively lead in the areas where value is actually created – and not primarily in the office [3] – as mentors and problem-solving coaches [1]. Analyzing problems by practicing daily meetings and routines at the place of value creation lead to a more intensive exchange of information [1].

Especially in production companies that apply Lean Production principles, managers are described as teachers, coaches, and mentors who show presence at the place of value creation and conscientiously exemplify the pursued principles and values [4]. This helps to establish a values-based management culture [5].

Increasing complexity in production – in particular, due to shortened cycles of innovation and growing diversity in variations – results in increasing demands for information management in production [6]. This creates new challenges for managers [7]. They must coordinate a large number of different tasks [9]. Managers have to react flexibly to the changing framework conditions surrounding leadership and the use of new software systems in the company

[9]. Flexibility and agility are considered important characteristics for managers [8].

Digital information and communication systems are designed to support managers in carrying out their work and to improve the quality of that work [10]. Polakoff [11] forecast this workload reduction in 1987 by arguing that new computerized production technologies would free managers from routine tasks, leaving them more time for employees and their needs.

In order to identify digital support options for managers, it makes sense to first consider the everyday work of managers in more detail to determine the extent to which using software makes sense and the tasks where implementing software could be useful. For several decades, research on manager activities has focused on manager work structures. Still, relatively little is known about the activities managers actually carry out in their everyday work [12,13]. In addition, analyzing the time required for different tasks is one of the most important foundations of effective management [14]. However, management tasks are difficult to categorize into routine everyday processes, and thereby to reflect fully in uniform activity analyses [15]. There is a range of everyday management activities that essentially cannot be planned, although they are part of the manager's duties, such as meetings announced on short notice or holding discussions with employees [16].

One goal of the project Arbeit 4.0 - AWARE is to improve the work of managers on the shop floor. To do so, it aims to identify routine administrative tasks that can be reduced or eliminated through digital support, leaving more time for real management tasks. In addition, it works to pinpoint deficits in information delivery, to derive recommendations for action to improve information management. To achieve the project's goal, semi-standardized, problem-focused interviews were held with managers from production at an international company in the capital goods industry. The survey respondents were asked to assess which management tasks are important, which are time-intensive, which routine tasks they carry out, what digital instruments are useful in their everyday work, and what instruments they still need. The results of the interviews were prepared and discussed with the managers in question. This paper presents the types of waste identified in shop floor management, which can serve as fields of action for the project. In this paper, all work performed by managers on the shop floor that does not directly serve the purposes of shop floor management is considered a type of waste. Accordingly, the theoretical fundamentals (section 2) present what is meant by shop floor management in the Toyota Production System (TPS). Section 3 describes the procedure with the selected method of data collection and evaluation. Section 4 describes the types of waste, which also serve as fields of action within the project. Finally, the paper provides a brief outlook describing the next steps of the project (section 5).

2 THEORETICAL FUNDAMENTALS

Manager development is an important building block in the TPS, since managers ensure the framework conditions required for high work motivation among employees [17] and must manage their areas of responsibility like business owners [18]. Managers assume the role of guiding mentors who support subordinate employees in carrying out the continuous improvement process, by assisting them in finding solutions and drawing their attention to optimizing processes [3]. Independently looking for solutions encourages a learning process among employees. Managers and employees work together intensively [3]. Dombrowski and Mielke [19] also posit that the success of Lean Leadership, a sustained type of management, is active participation by employees in everyday improvements. Lean Leadership creates the framework conditions for ongoing development of the production system [19]. Managers are considered a central element in the TPS, and accordingly must fulfill high expectations [18]. Four performance criteria are used at Toyota to assess manager effectiveness [20]:

1. Safety – Avoiding work accidents and improving ergonomics
2. Quality – Process improvements and problem-solving
3. Productivity – Consistent resource management and long-term fulfillment of customer demand
4. Costs – Fulfilling the first three criteria while monitoring and reducing overall costs

If performance improvements are found for these four criteria, it is assumed that employee skills have also improved. This progress is also credited to the work of the manager [18]. Liker and Meier [20] also describe requirements for managers, which reflect necessary personal characteristics:

- A desire and a will to lead: A true will to lead is a fundamental requirement for managers, not just the desire to hold a certain position
- Understanding of the work and processes to be performed: Specific knowledge of the tasks involved in the work area
- Understanding of their own role as a manager: Understanding the responsibilities of a manager, e.g. knowledge of company policies, health and safety regulations
- Ability to carry out continuous improvements: Ongoing analysis of the work area, detecting and implementing potential increases in efficiency
- Ability to lead: Managers must achieve company goals by managing team members; ability to identify the need for training and to plan training sessions
- Ability to learn: Ability to transmit knowledge

The Gemba or Gemba Kaizen design principle from the TPS, which can be translated loosely as “a visit to production for personal inspection” [18], is essential for managers to identify the actual problems in production. Gemba

is where development and production take place. More specifically, Gemba describes the work station where specific activities are carried out [21]. It is a manager's duty to be close to where value creation takes place because this is where all of the relevant information is and where potential areas of improvement can be identified. According to Imai [21], the principles of Gemba are as follows:

- First go where the problem or irregularity occurred
- Review the situation
- Take immediate counter-measures
- Look for the causes of the problem
- Standardize the solution to the problem to prevent it from occurring again

Management on the shop floor is divided into four central elements [5]:

- Management on site
- Recognizing deviations
- Sustainable problem solving and avoidance
- Optimizing the use of resources

Management on-site means that managers are present where value is created. They detect deviations from the standard quickly. Another way to do this is to visualize current conditions through key figures, which make deviations visible at once. In addition, daily shop floor meetings are held in production to discuss deviations with the team and be able to react to these as quickly as possible [5]. Problems must be solved in a sustainable manner, i.e. it is important to understand and correct the actual cause of the problem instead of concentrating only on quick immediate measures [5]. In addition, problems must be understood as opportunities for improvement, because a common saying among Toyota manager is "Not having any problems is a problem" [3]. Instead of looking for culprits, the thinking is to look for the fault in the process, in standards, visualizations or qualifications [3]. Only in a structured problem-solving process, where employees receive active support from manufacturers and are involved in the process as problem solvers, errors can be corrected permanently [5]. Operational resources to be managed include employees, machines, and time. These must be managed in a transparent manner so that they can be used effectively and efficiently [5].

3 METHOD

A process consisting of five steps has been selected to identify fields of action for improving shop floor management. These are outlined in Figure 1 and described in the following.

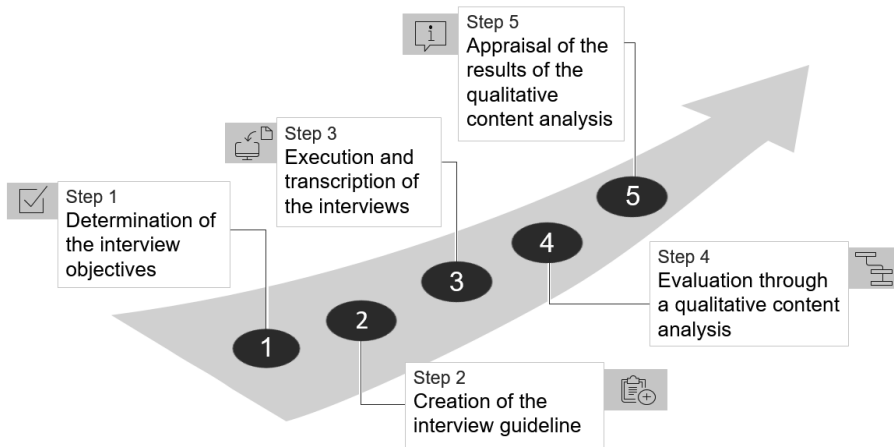


Figure 1: Process and methodology.

(1) Determination of the interview objectives

The interview is held for the following purposes:

- Identification of administrative tasks that can be reduced or eliminated through digital support, leaving more time for real management tasks
- Identification of time-consuming and important management tasks to determine possible discrepancies between important and time-consuming tasks and thereby identify potential improvements
- Identification of deficits in information delivery and deriving recommended actions for these
- Identification of existing and missing digital instruments to support management tasks

(2) Creation of the interview guideline

The problem-centered interview was selected as a survey instrument since this type of survey includes the explanations, justifications, and opinions of the person surveyed. This interview type focuses on a narrative principle and the interviewer consistently focuses the discussion on existing problems [22]. Another characteristic of problem-centered interviews is the interviewer's objective consideration of the topic and relevant literature in order to define a problem, as it was already done in formulating the objectives [22]. A questionnaire was developed to implement the problem-centered interview. However, the interview was carried out in only a partially standardized manner, in order to ask follow-up questions tailored to the respondent's answers and react flexibly to their responses [23]. The critical incident technique was used to develop the questionnaire. This technique is used in

the literature to analyze everyday work tasks and identify requirements in the work environment. The surveyed personnel should be familiar with the situation to be analyzed and be able to report on examples of successful and unsuccessful incidents [24, 25].

The interview guideline includes questions on the following topics:

- management tasks on the shop floor [26],
- personal information provision and processing,
- digitalization and
- training.

The following selected questions were used to shed light on the activities of managers:

1. Which of your activities do you consider to be real leadership activities?
2. Which of your activities have a more administrative character?
3. Which of the activities mentioned predominate in your everyday life? Name the three activities that take up the most time.
4. Which of these activities do you consider to be the most important? Name your three most important activities.
5. What changes in your activities would you like to see in order to make your everyday life more effective?

(3) Execution and transcription of the interviews

Ten interviews were conducted with managers at an international company in the capital goods industry. Managers from the following corporate areas were surveyed: Mechanical production, gear assembly, service, process controlling and operational management. Two people wrote down answers to the questions, which were then transcribed digitally.

(4) Evaluation through a qualitative content analysis

Evaluation of the interviews was carried out using quantitative content analysis according to Mayring. The systematic, regulated process of qualitative content analysis makes it possible to process large quantities of material and analyze them step by step [27]. The method of structured inductive category definition involves five steps:

1. Paraphrasing passages with important content
2. Summarizing the most important information from individual questions
3. Listing the higher-level categories
4. Forming categories for types of waste/fields of action within shop floor management
5. Reviewing the comprehensive category system based on initial materials

When summarizing the most important statements on individual questions (step 2), a quantitative analysis of some items was also completed, for instance, to find out how many managers perceive individual tasks as important or as time-intensive.

(5) Appraisal of the results of the qualitative content analysis

During a workshop, the results of the qualitative content analysis from the interviews were presented to selected managers, in order to identify potential errors in interpreting interview results and analyze the identified fields of action.

4 RESULTS

The selected process provided the following results:

- There is no uniform understanding of real management tasks, since the question, what real management tasks are, resulted in very different answers. For example, only four respondents named developing the skills of employees as a real management task. In contrast, the ability to teach is considered one of the most important requirements for managers in the literature [20].
- There is a discrepancy between management tasks perceived to be time-intensive and tasks perceived to be important by respondents. In the opinion of the respondents, the greatest amount of time is not spent on the most important tasks. For example, five respondents viewed preparing key figures as the most time-intensive task, while seven respondents felt interacting with employees was the most important task.
- In addition, qualitative content analysis was used to identify four deficits in shop floor management, respectively information management (see Figure 2). These can be interpreted as waste in shop floor management.

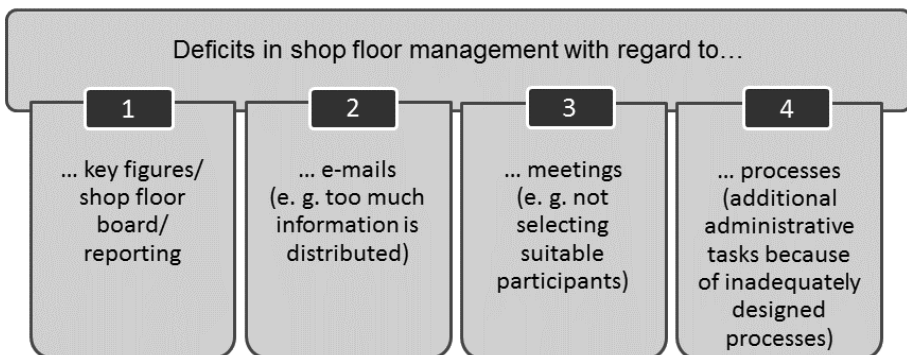


Figure 2: Deficits in shop floor management.

(1) Managers must complete a variety of administrative tasks that involve preparing key figures for the shop floor board and for reporting. Examples of these deficits include manually entering data on the key figure OEE (Overall

Equipment Effectiveness) and manually linking information from various systems, which can often result in errors. In addition, manually entering and preparing (process) data, which is often associated with errors, makes the task of detecting deviations (a central element of shop floor management [5]) much more difficult.

(2) E-mail correspondence was named as an important source of information by five of the managers surveyed. One negative aspect described in this context was that too much information is distributed in the e-mails to too many recipients, without prioritizing the topics included. This type of information delivery can sometimes result in long searches through the e-mails for useful information.

(3) Failing to design meetings in a targeted way makes it more difficult to achieve the intended results of the meeting. In addition to not selecting suitable participants for meetings, the respondents stated that in some case there is no documentation of important meeting results. Often, no minutes are kept of meetings.

(4) The biggest deficits in information management relate to different internal corporate processes. Managers have to handle administrative tasks, the result of inadequately designed business processes and a failure to tap into potential areas of optimization. For example, staff planning is more difficult if there is no uniform qualification matrix for employees. Another example relates to the complaint management process. Currently, it is not possible for customers to provide online notification of complaint orders and the process is not transparent enough, resulting in planning errors and additional coordination work for managers. The lack of a Manufacturing Execution System (MES) creates administrative work for managers in obtaining information. In some cases, errors identified by employees have to be digitally recorded in quality management systems by managers. In summary, it can be stated that an inadequate design of individual processes leads to additional, often unscheduled coordinating or administrative activities for managers.

5 OUTLOOK

The results illustrated here were presented to and discussed with the general management and executives in a workshop. The next step will be to work through individual fields of action within the project. Designing a system of key figures will be a primary focus, in order to respond to the informational needs of managers and employees. As a result of the project, management principles and instruments should be described in detail in the context of digitalization, and training guidelines should be prepared for shop floor management.

REFERENCES

- [1] Hertle, C., Siedelhofer, C., Metternich, J., Abele, E. (2015) The next generation shop floor management - how to continuously develop competencies in manufacturing environments, in The 23rd International Conference on Production Research 2015.
- [2] Grundnig, A., Meitinger, S. (2013) Führung ist nicht alles - aber ohne Führung ist alles nichts. Shopfloor-Management bewirkt nachhaltige Effizienzsteigerung, Zeitschrift für wirtschaftlichen Fabrikbetrieb 108 (3): 133–136.
- [3] Bertagnolli, F. (2018) Lean Management. Einführung und Vertiefung in die japanische Management-Philosophie, Wiesbaden, Springer Fachmedien Wiesbaden.
- [4] Dahm, M. H., Brückner, A. D. (2017) Lean Management im Unternehmensalltag. Praxisbeispiele zur Inspiration und Reflexion, Wiesbaden, Springer Fachmedien Wiesbaden.
- [5] Peters, R. (2017) Shopfloor Management. Führen am Ort der Wertschöpfung, Stuttgart, LOG_X Verlag GmbH.
- [6] Bornewasser, M., Bläsing, D., Hinrichsen, S. (2018) Informatorische Assistenzsysteme in der manuellen Montage: Ein nützliches Werkzeug zur Reduktion mentaler Beanspruchung? Zeitschrift für Arbeitswissenschaft 72 (4): 264-275.
- [7] Schwarzmüller, T., Brosi, P., Welp, I. M. (2015) Führung im digitalen Zeitalter, in Digitales Neuland, T. Becker, C. Knop, eds., Wiesbaden, Springer Fachmedien Wiesbaden:155–166.
- [8] Schwarzmüller, T., Brosi, P., Welp, I. M. (2017): Führung 4.0 - Wie die Digitalisierung die Führung verändert, in CSR und Digitalisierung, A. Hildebrandt, W. Landhäußer, eds., Berlin, Heidelberg, Springer Berlin Heidelberg: 617–628.
- [9] Frost, M., Sandrock, S., Schüth, N. (2016) Potenziale der digitalen Arbeitswelt für Führung und Qualifizierung. Erfahrungsberichte und Empfehlungen von 4.0 Experten, Zeitschrift für wirtschaftlichen Fabrikbetrieb 111 (10): 639–644.
- [10] Gluchowski, P., Gabriel, R., Chamoni, P. (1997) Management Support Systeme. Computergestützte Informationssysteme für Führungskräfte und Entscheidungsträger, Heidelberg, Springer Berlin Heidelberg.
- [11] Polakoff, J. C. (1987) Will middle managers work in the 'factory of the future'? Management Review: 50–51.
- [12] Jankurová, A., Ljudvigová, I., Gubová, K. (2017) Research of the Nature of Leadership Activities, Economics & Sociology 10 (1): 135–151.
- [13] Hales, C. P. (1986) What do managers do? A critical review of the evidence, Journal of Management Studies 23 (1): 88–115.
- [14] Kevenhörster, P., Schönbohm, M. A. (1974) Zeitökonomie im Management, Opladen, Westdeutscher Verlag.

- [15] Müller-Böling, D., Ramme, I. (1990) Informations- und Kommunikationstechniken für Führungskräfte. Top-Manager zwischen Technikeuphorie und Tastaturphobie, München, Oldenbourg Verlag.
- [16] Davoine, E., Tscheulin, D. K. (1999) Zeitmanagement deutscher und französischer Führungskräfte - Ergebnisse einer empirischen Untersuchung, *Die Betriebswirtschaft* 59 (4): 443–457.
- [17] Liker, J. K., Hoseus, M. (2009) *Die Toyota Kultur. Das Herz und die Seele von "Der Toyota Weg"*, München, Finanzbuch Verlag.
- [18] Liker, J. K., Meier, D. P. (2011) *Praxisbuch Der Toyota Weg. Für jedes Unternehmen*, München, Finanzbuch Verlag.
- [19] Dombrowski, U., Mielke, T. (2012) Lean Leadership – Nachhaltige Führung in Ganzheitlichen Produktionssystemen, *Zeitschrift für wirtschaftlichen Fabrikbetrieb* 107 (10): 697–701.
- [20] Liker, J. K., Meier, D. (2006) *The Toyota Way Fieldbook. A practical guide for implementing Toyota's 4Ps*, New York, McGraw-Hill.
- [21] Imai, M. (2007) Gemba Kaizen. A Commonsense, Low-Cost Approach to Management, in *Das Summa Summarum des Managements. Die 25 wichtigsten Werke für Strategie, Führung und Veränderung*, C. Boersch, R. Elschen, eds., Wiesbaden, Gabler: 7–15.
- [22] Kurz, A., Stockhammer, C., Fuchs, S., Meinhard, D. (2007) Das problemzentrierte Interview, in *Qualitative Marktforschung. Konzepte - Methoden – Analysen*, R. Buber und H. H. Holzmüller, eds., Wiesbaden, Betriebswirtschaftlicher Verlag Dr. Th. Gabler, GWV Fachverlage GmbH Wiesbaden: 463–475.
- [23] Magerhans, A. (2016) *Marktforschung. Eine praxisorientierte Einführung*. Wiesbaden, Springer Fachmedien Wiesbaden.
- [24] Stitt-Gohdes, W. L., Lambrecht, J. J., Redman, D. H. (2000) The Critical-Incident Technique In Job Behavior Research, *Journal of Vocational Education Research* 25 (1): 59–84.
- [25] Fisher, S., Oulton, T. (1999) The Critical Incident Technique in Library and Information Management Research, *Education for Information* 17: 113–125.
- [26] Walgenbach, P. (1994) *Mittleres Management. Aufgaben - Funktionen – Arbeitsverhalten*, Wiesbaden, Gabler.
- [27] Mayring, P. (2010) *Qualitative Inhaltsanalyse. Grundlagen und Techniken*, Weinheim, Beltz.

This research and development project AWARE is funded by the Ministry of Economic Affairs, Innovation, Digitalization and Energy of the State of North Rhine-Westphalia (MWIDE) in the context of the Leading-Edge Cluster “Intelligent Technical Systems OstWestfalenLippe (it’s OWL)” and supervised by Project Management Jülich (PTJ).