

# Lean production and willingness to change

German industrial survey

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## 1. Introduction

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### 1.1. Background

The Massachusetts Institute of Technology led a global benchmark analysis within the automotive industry in the late 1980s. The results showed significant differences in the organization of production between Western and Japanese companies. For these differences one of the researchers involved, John Kraftcik, distinguished between “lean” and “buffered” production systems. In addition to the fact that Japanese car builders met higher quality standards, also productivity and flexibility were significantly higher in these companies. Against a growing competitive pressure from globalization and short product life cycles due to technical progress a flexible production organization is increasingly important to still remain competitive. Therefore the first main question of this article is, how nowadays industry has responded to the results of the mentioned study and set up structured holistic production systems.

Taiichi Ohno, the designer of the Toyota production system, had to cope with the resistance of employees during the introduction of lean production at Toyota. It took about ten years until lean production was implemented at Toyota. This was because existing resistances had to be dismantled and overcome and to achieve a complete reorganization of production. Ohno emphasized the importance of the involvement and training of all workers for a successful implementation. Already this example shows, the willingness to change of the staff involved is very important for success of the implementation of lean concepts. This raises the second major question of this survey whether and to what extent producing companies are ready and open for change.

The aim of this article is to provide an overview about both dimensions, the degree of penetration of lean methods and the willingness to change in the field of production.

### 1.2. Target group and survey details

The target group of this survey was managers of German companies responsible for production. This target group was identified out of a large firm database for German producing companies of all relevant branches. In sum 3,860 companies were contacted and supported with an online questionnaire, so a media break could be avoided. From this number of contacted managers, 98 answered to the survey, this complies with a response rate of 2.5 %. Thereby the questionnaire was divided into different subjects, through which the surveyed person could navigate with the aid of forward and backwards buttons. The division was chosen such that every section is treated on a separate page, which warrants the clarity and the transparency for the surveyed person. The majority of the questionnaire consists of assessment tasks. For the evaluation, a scale of one to five was used. Endpoints were continuously indicated with “not agree” to “fully agree”. The part which could not be covered by assessment tasks contains multiple choice questions.

The survey was divided into four main subjects: company and respondents characteristics, an initial question regarding the relevance of the topic, methods of holistic production systems and criteria of willingness to change.

## 2. Evaluation and analysis of data collection

### 2.1. Company and respondents characteristics

In the section of company characterization, three different aspects were surveyed. The first aspect was the size of the production site, which extends over five size ranges of less than ten up to more than 500 employees. The industry in which the company operates is the second aspect. Nine answering options were leaned against the branches division in the German company database, plus the category “others”. Third aspect is the number of units produced, which are divided into low or high volume production, special machines/ single pieces and process industry. In the field of respondent characterization, four features are gathered, with which surveyed persons could be classified into several clusters during the evaluation. Apart from age and sex, such clusters include also the duration of employment, which is divided into four subcategories. The third characteristic subdivides interviewees into employees with and without managerial responsibilities. When employees dispose of managerial responsibilities, a further division is made with help of these three categories: less than 10, 10 to 30 and more than 30 employees; see therefore Figure 1 - Figure 6.

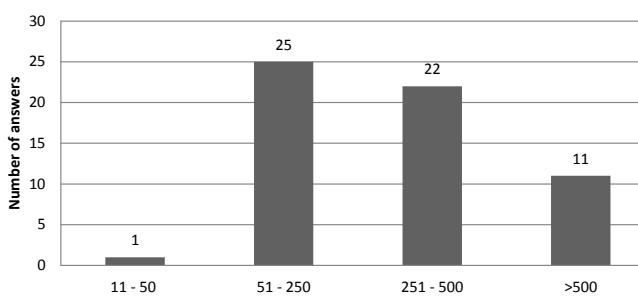


Figure 1: Number of employees of the production site (n = 59 companies)

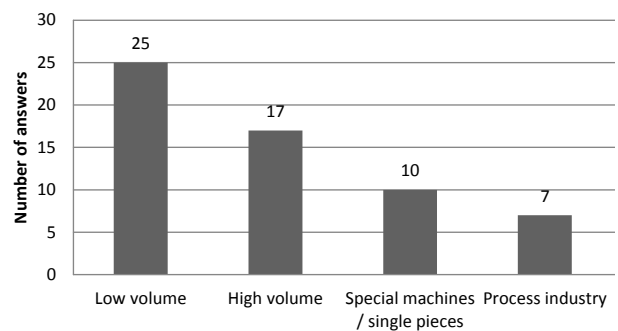


Figure 2: Class of units produced in the production site (n = 59 companies)

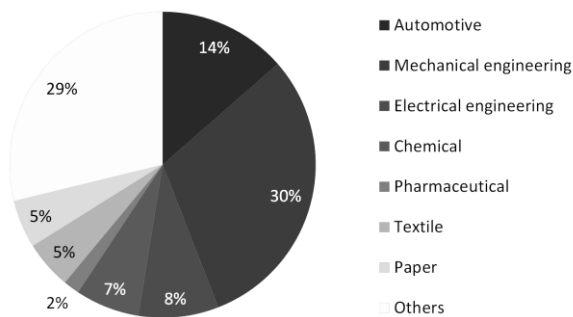


Figure 3: Branch of the production site (n = 59 companies)

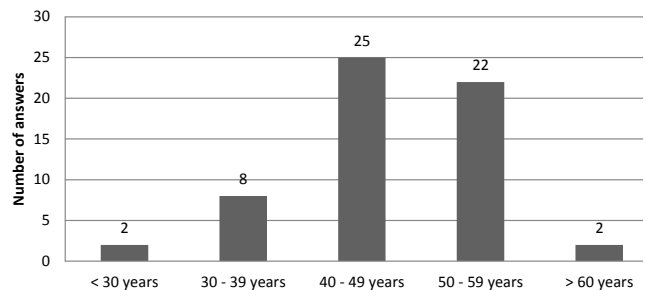


Figure 4: Age of the surveyed managers (n = 59 companies)

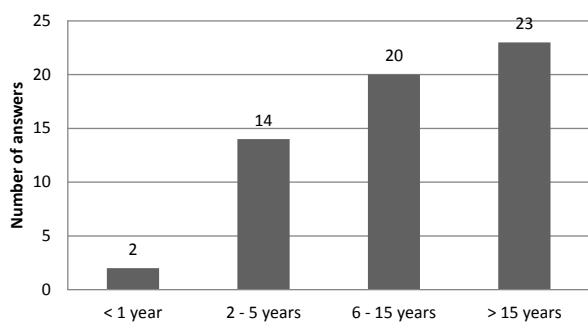


Figure 5: Seniority of the surveyed managers (n = 59 companies)

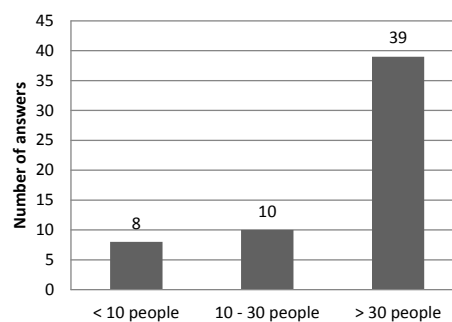


Figure 6: Managerial responsibility of the surveyed managers (n = 57 companies)

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## 2.2. Relevance

The initial question of the survey served primarily to pin the scope of the survey and to arouse interest. In the initial question subjects were asked to estimate whether lean production is a suitable approach to help companies gain a competitive advantage over competitors, see therefore Figure 7. 89 percent (84 answers) of all 95 respondents believe that competitive advantages can be gained by implementing lean methods. Another five percent (6 answers) do not know whether competitive advantages can be achieved, and about three percent (5 answers) do not believe in gaining competitive advantage through the implementation of lean methods.

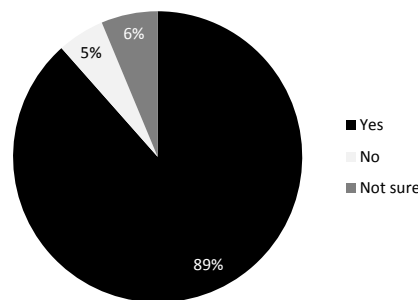


Figure 7: Methods of lean production as suitable tools to help companies to gain a competitive advantage over competitors (n = 95 companies)

## 2.3. Methods of holistic production systems

Questions about methods of holistic production systems, especially the concepts of lean production, constitute the largest segment of the survey. Considered methods were subsumed under eleven categories, which respectively have thematically similar references. In all, eleven blocks were formed. The first categories were the ones that are related to the process level (total productive maintenance, optimization of setup time, process time management and poka yoke). Afterwards, categories that belong to the process chain were considered (production system and material flow) following the category of manufacturing execution systems, and then organizational, system-related contents (performance management, organization of workplace, visual management as well as standardization and audit).

The following paragraphs show the results of the survey regarding different methods of holistic production systems. Here process-related, process-chain-related and system-related methods were in the focus. In the following figures the degree of agreement regarding the several questions is measured in a qualitative range between “very low” and “very strong”.

### 2.3.1. Total productive maintenance

The results for the category total productive maintenance are visualized in Figure 8. It should be noted that the number of responses varies between 73 and 77. In general it can be stated that the results for this area are quite heterogeneous. The concept of TPM is used by about 50 percent of the companies regularly.

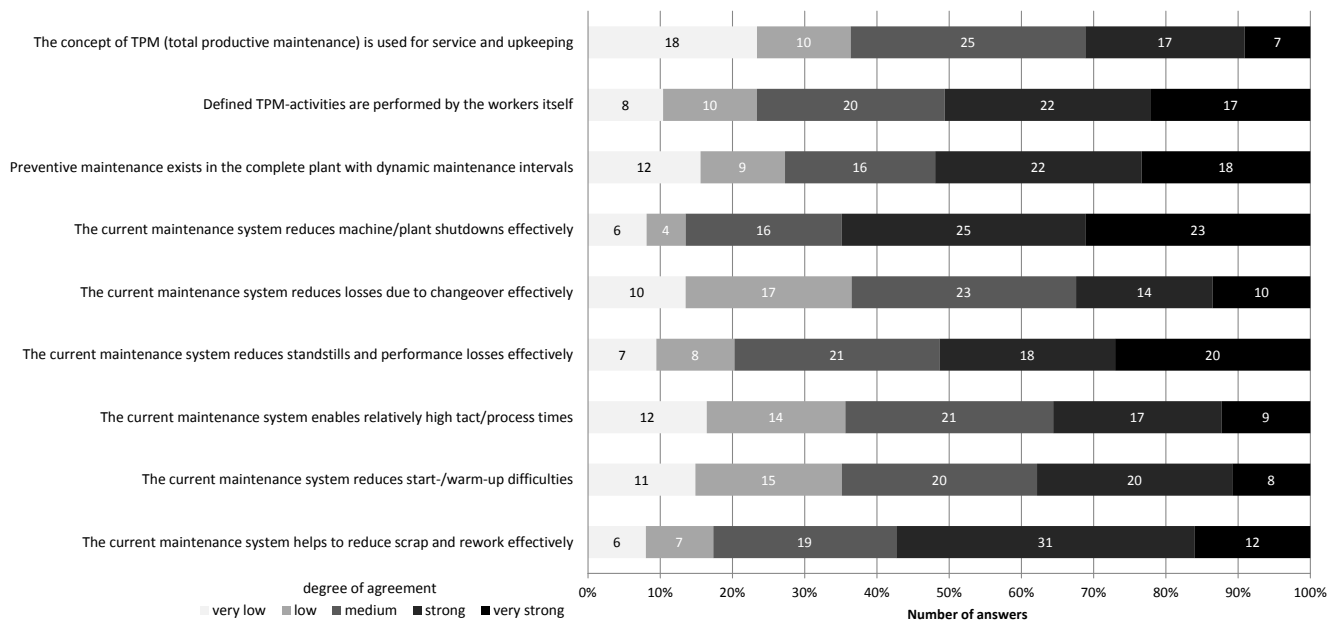


Figure 8: Results in the category TPM (total productive maintenance)

### 2.3.2. Changeover improvement

The next category deals with the systematical improvement of setup times. The results are shown in Figure 9. The number of responses varies depending on the statement between 72 and 74. In most companies a setup time is carried out in production. Slightly less than half of the respondents indicated affirmative responses. About another 30 percent chose the neutral range and the remaining nearly 22 percent spread over the negative range. The performed setup time improvements occur only in rare cases on the basis of the SMED (single minute exchange of die) method.

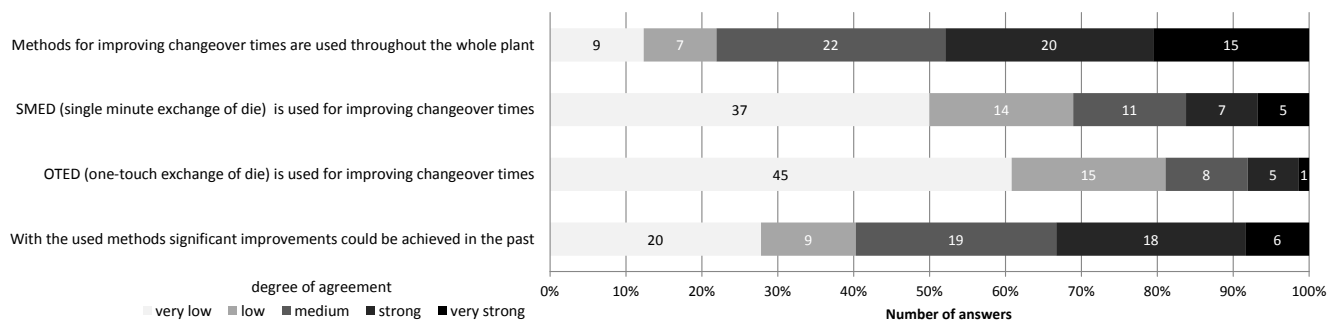


Figure 9: Results in the category changeover improvement

### 2.3.3. Process time management

Figure 10 presents the results for the category process time management. The number of responses for the third statement is 70, for the further statements each 71. Nearly three-quarter of all respondents confirm that in production target times for the execution of activities are determined. The MTM method for determining target time is used by very few companies, about 20-30 percent.

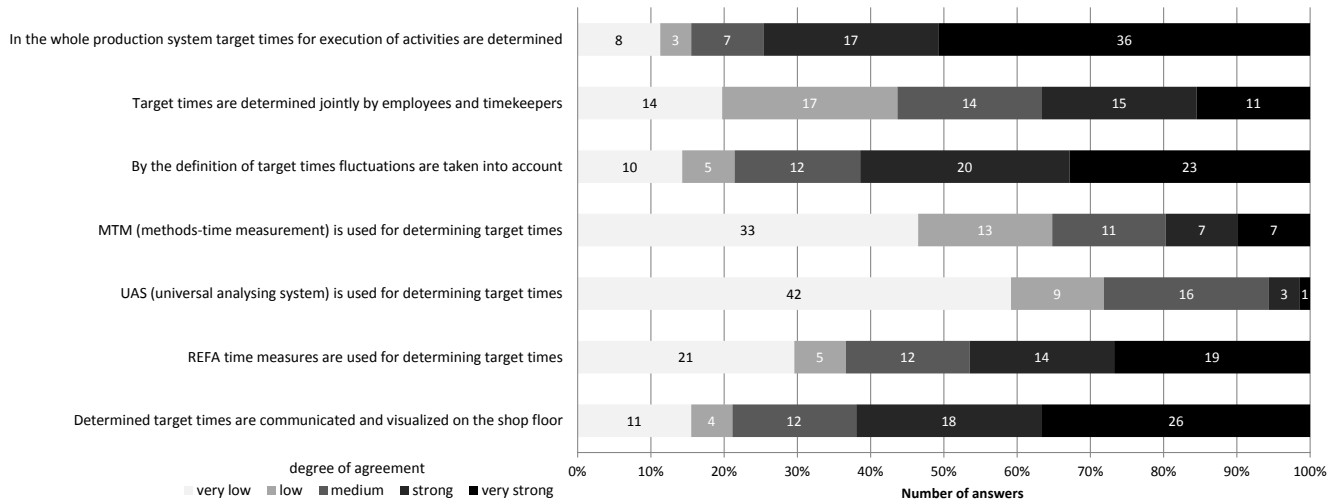


Figure 10: Results in the category process time management

### 2.3.4. Poka Yoke

The results of the category poka yoke are shown in the illustration of Figure 11. In about 20 percent of the companies all processes and resources are designed so that faulty operation does not lead to defective products or hazards. This compares to 16 percent in which poka yoke is not applied at all. The rest of the observed companies partially uses the concept of poka yoke.

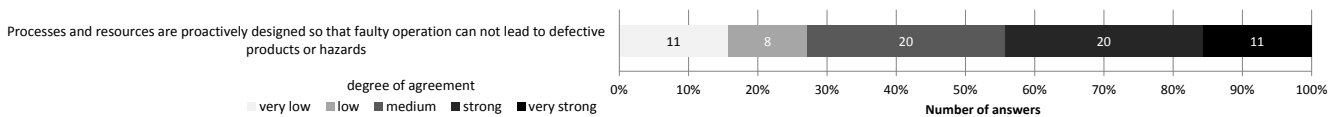


Figure 11: Results in the category poka yoke

### 2.3.5. Production system and systematical improvement

The distribution of responses to the category production system and systematical improvement is shown in Figure 12. In this section mainly the method of value stream mapping is discussed. It should be noted that the number of responses varies between 66 and 68. A framework for methods for structural improvement (production system) exists in over half of the companies.

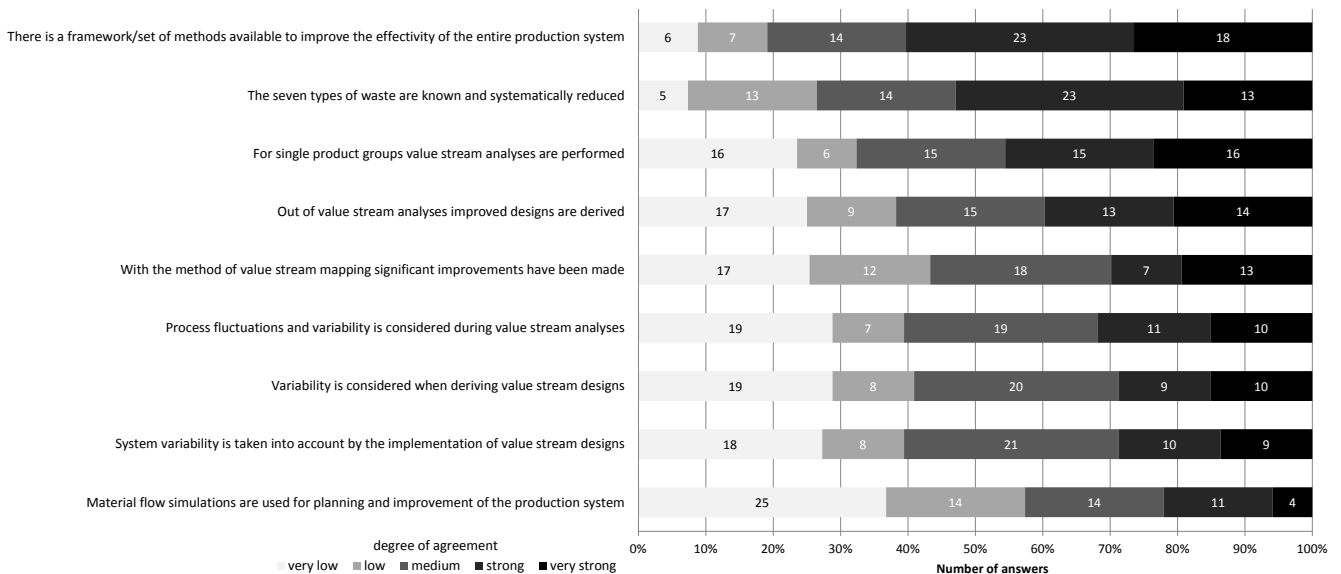


Figure 12: Results in the category production system and systematical improvement

### 2.3.6. Material flow

Figure 13 presents the results of the category material flow. It should be noted that the number of answers varies between 62 and 64. The distribution of responses in this section is quite heterogeneous. It ranges from consent to obvious rejection.

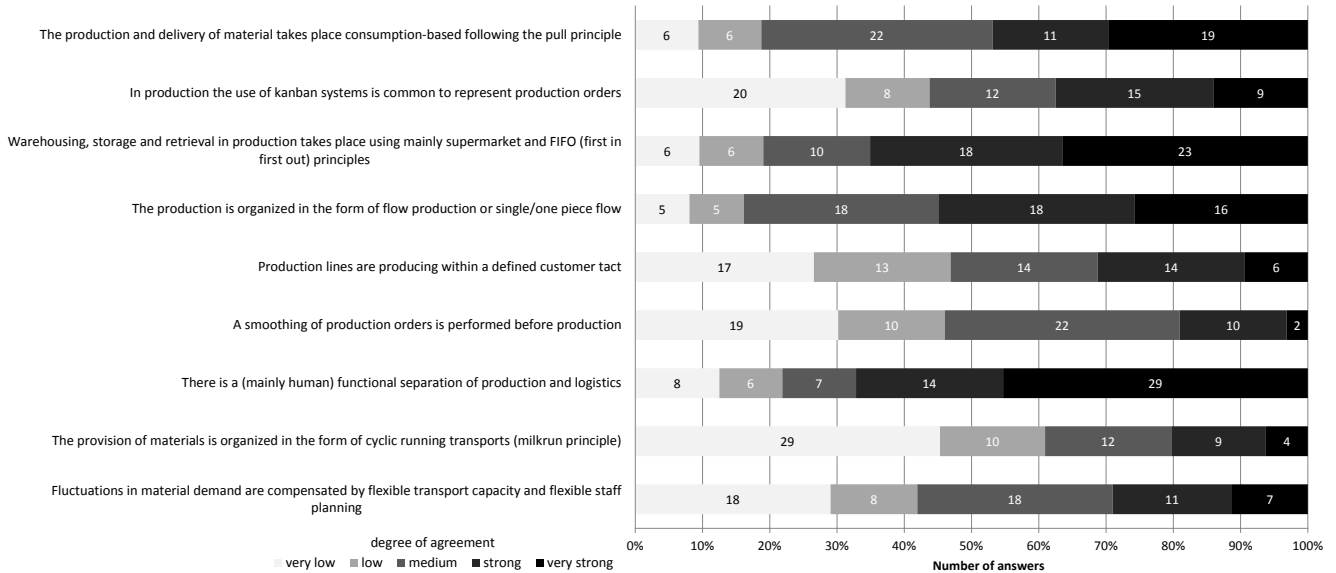


Figure 13: Results in the category material flow

### 2.3.7. Manufacturing execution system

The distribution of responses in the category manufacturing execution system is plotted in Figure 14. The number of responses varies between 60 and 63. It can be noted that the majority of the statements were answered with a broad consensus. In almost 80 percent of the surveyed companies the order management is at least partially coordinated with the help of a MES (manufacturing execution system), in a little more than 40 percent of the companies this is done in the complete production area.

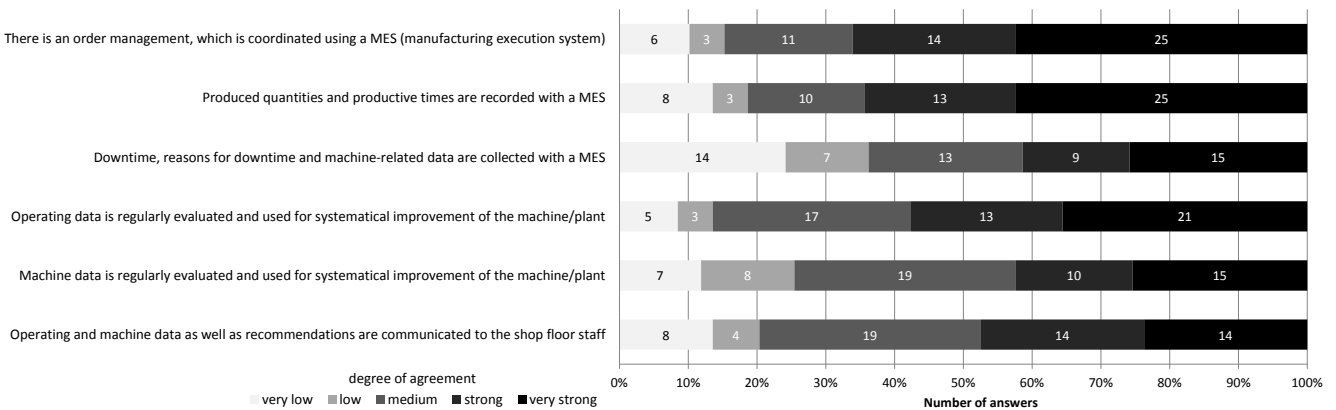


Figure 14: Results in the category MES (manufacturing execution system)

### 2.3.8. Performance and shop floor management

Figure 15 presents the results for category performance and shop floor management. The answer number varies depending on the statement between 57 and 61. Based on the figure it can be seen that apart from the OEE the queried KPIs are used in about 80 percent of the companies. The KPI most frequently raised is the utilization ratio.



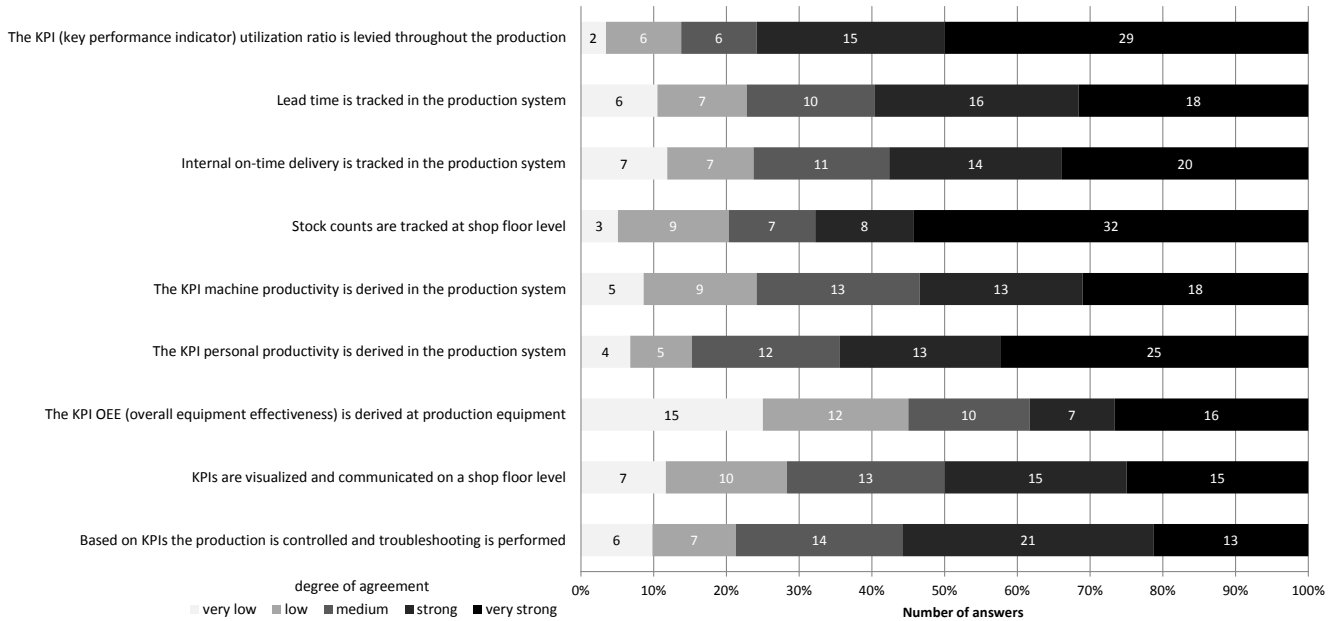


Figure 15: Results in the category performance and shop floor management

### 2.3.9. Order and cleanliness

The results of the category order and cleanliness in production are shown in Figure 16. It should be noted that the number of answers is between 59 and 61. In general it can be stated that the establishment of order and cleanliness at least partially is carried out at workplaces by the vast majority of companies. The statement that the establishment of order and cleanliness is achieved with methodical support is answered positively by over 65 percent of respondents.

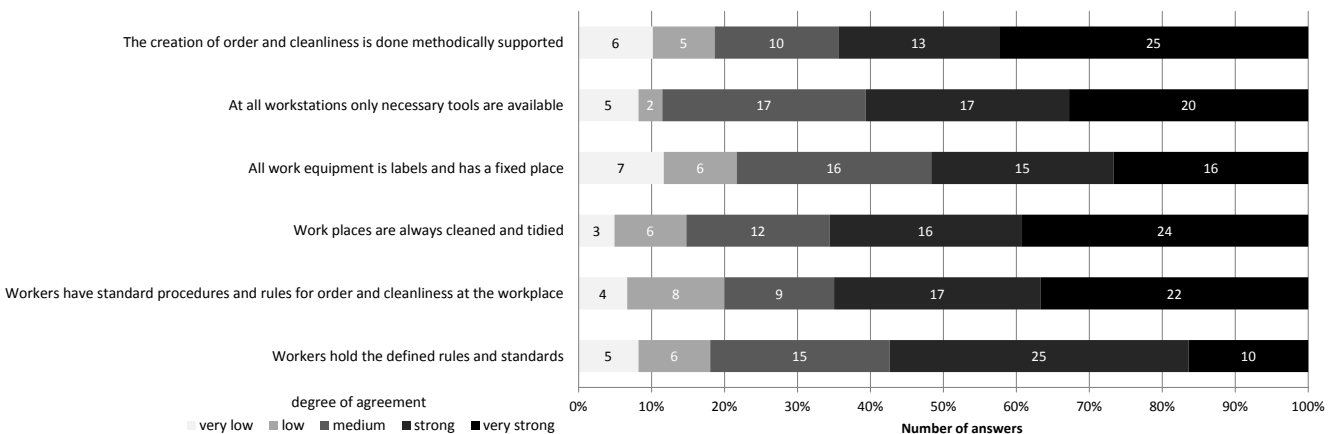


Figure 16: Results in the category order and cleanliness

### 2.3.10. Visual management

Figure 17 presents the results of the category visual management. The category was answered by 61 respondents. Visual aids and control systems for displaying relevant information and to create transparency exist in about 80 percent of companies surveyed, at least partially.

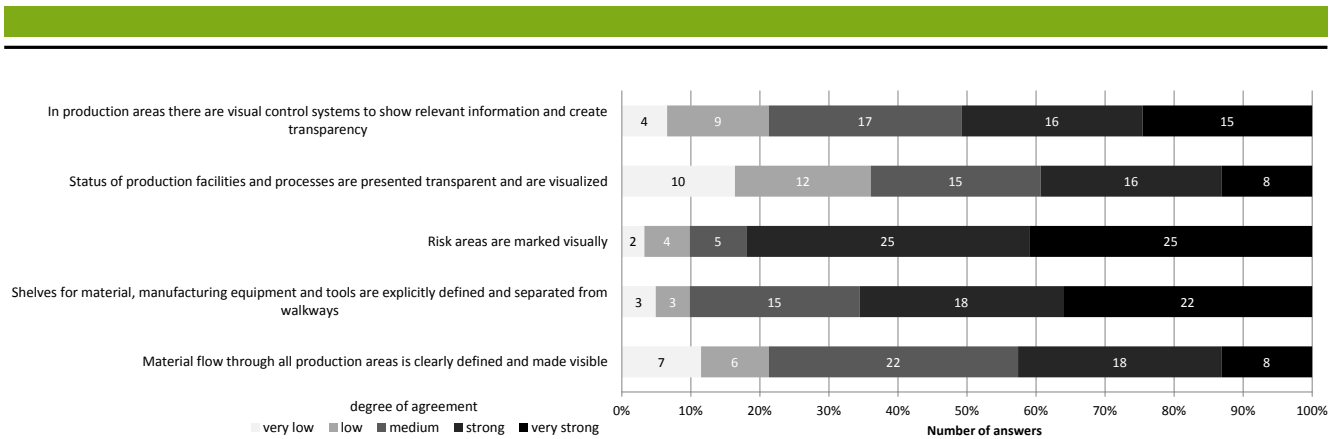


Figure 17: Results in the category visual management

### 2.3.11. Standardization and audits

The results of the category standardization and audits are shown in Figure 18. The number of responses is between 59 and 61. It is striking that this category received the least support. Uniform standards are at least partially used in three-quarters of companies.

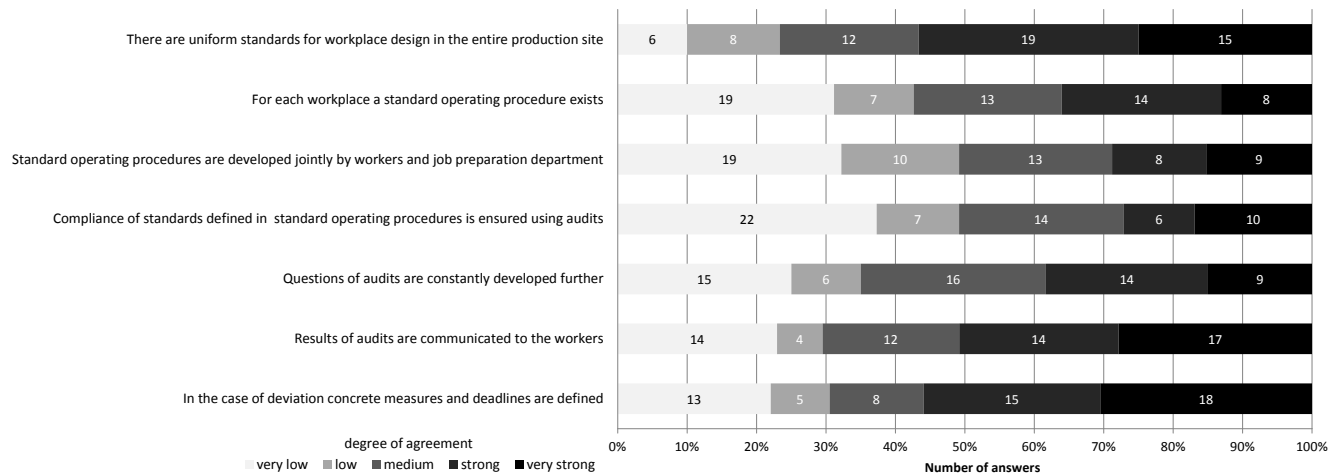


Figure 18: Results in the category standardization and audits

## 2.4. Criteria of willingness to change

Questions about the willingness to change were divided in six different categories. It should be noted that a large part of questions required subjective assessment of persons surveyed, with which the willingness to change among the company was deduced.

The following paragraphs show the results of the survey regarding criteria of willingness to change. The surveyed managers answered questions about their perception regarding their division as well as their personal mindset. In some of the following figures the degree of agreement regarding the several questions is also measured in the same qualitative range between “very low” to “very strong”.

### 2.4.1. Communication and transparency in the corporation

The results of this category are plotted in Figure 19. The response number for this category was between 59 and 61. It can be stated that the entire category is characterized by a broad consensus.

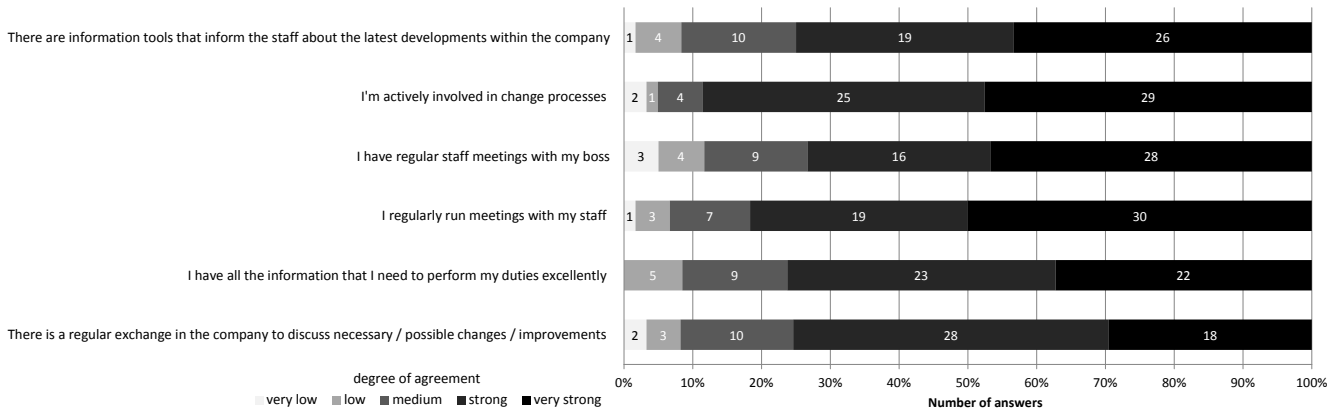


Figure 19: Results in the category communication and transparency in the corporation

### 2.4.2. Decision making and management culture

The results of the category decision making and management culture are shown in Figure 20. The response number for statement one is 59, for statement two 61 and for statement three 60.

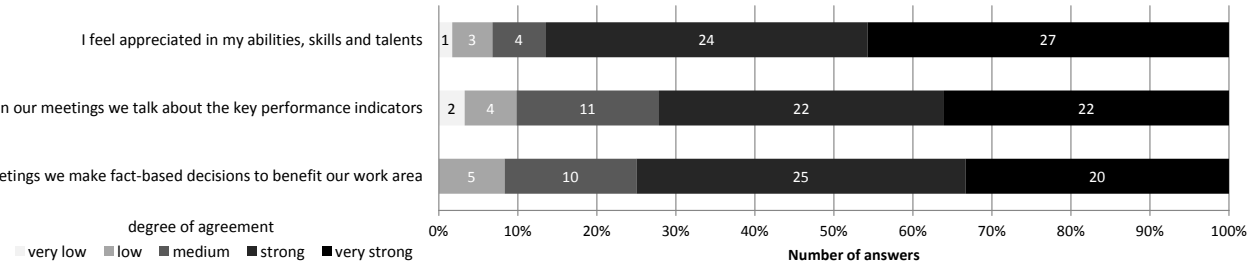


Figure 20: Results in the category decision making and management culture

### 2.4.3. Personal assessment of the company and the production system

In this category of the survey the personal opinion of the participants was collected on various issues. The results are plotted in Figure 21 and were answered by 60 managers. The first statement of this category, “my company is not open to change”, in contrast to the previous statements was counter-designed to ensure the validity of the questionnaire. Almost half of the participants estimated their company as open to change.

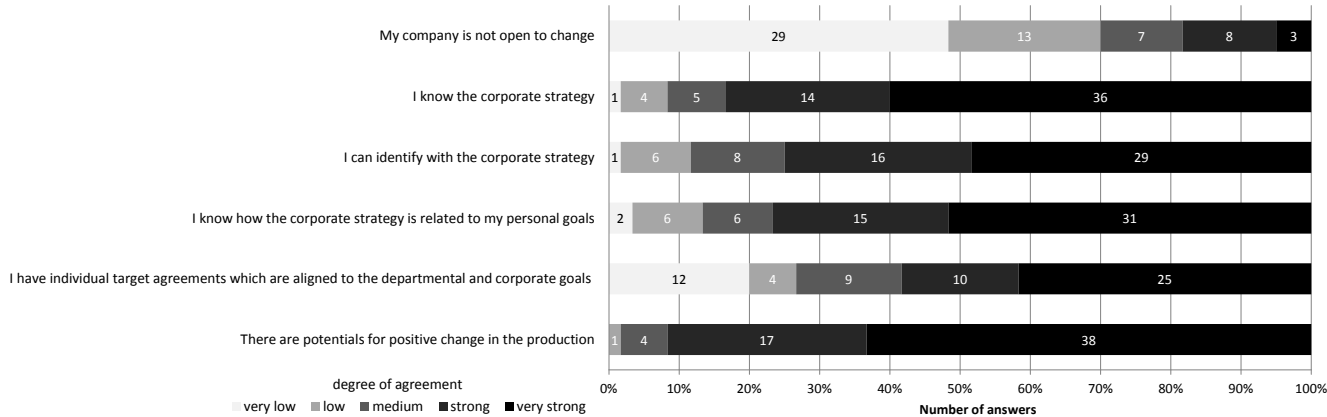


Figure 21: Results in the category personal assessment of the company and the production system

## 2.4.4. Employee suggestion system and continuous improvement

An employee suggestion system or a similar institution exists in 44 surveyed companies (n = 61 companies), representing about 73 percent. 16 companies (27 percent) do not have such an institution. The annual number of implemented improvements is plotted in Figure 22 differentiated between SME (small and medium-sized enterprises) with less than 250 employees and large enterprises with more than 250 employees. This question was answered only by the participants, who affirmed the existence of an employee suggestion system. The number of responses for this question is 43 because one respondent, who had previously answered with yes, did not answer this question.

The next question of the survey was how large the sum saved by the implemented suggestions is per year. The number of responses for this question was 42, see Figure 23. Slightly more than half of the surveyed companies save between 1,000 and 10,000 Euros per year. In 44 percent of the companies the saved sum is greater than 10,000 Euros per year. One participant stated that his company saves less than 1,000 Euros per year by proposals.

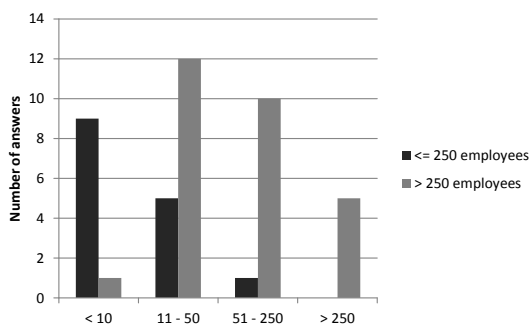


Figure 22: Number of annually implemented improvement suggestions from workers (n = 43 companies)

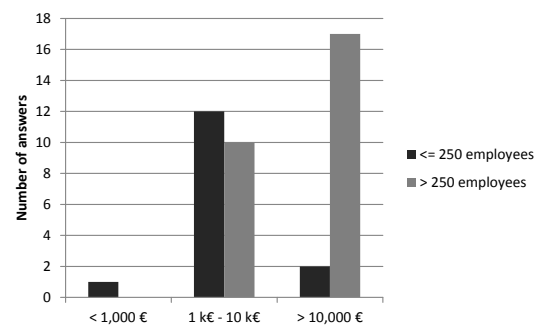


Figure 23: Savings through implemented improvement suggestions per year (n = 42 companies)

A further question, whether employees receive a bonus if their proposal is implemented, was answered by 43 managers. 34 managers (79 percent) confirmed that their employees receive a bonus, 9 managers (21 percent), however, denied the payment of a bonus in the event of a successful implementation of a proposal. In 83 percent (49 responses) of surveyed companies a regular (e.g. annual) training of staff exists. 17 percent (10 responses) of the participants denied a regular training of employees.

46 managers, representing a share of 77 percent, responded positively to the question of whether their company has taken advice from consultancies for change or improvement of processes in the past three years. 15 participants (23 percent) said no to this question. How often such a service was taken into advantage during the same period is plotted in Figure 24.

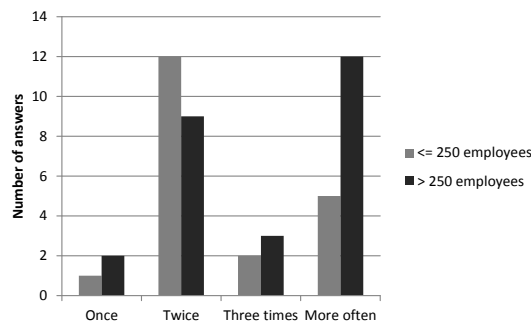


Figure 24: Quantity of in-house projects supported by consulting firms in the years 2011-2013 (n = 46 companies)

## 2.5. Cluster analysis

For the cluster analysis based on the company size and the type of production, the sample data was divided into six groups. The group SME includes all participating businesses with less than 250 employees. Interesting differences could be detected in the block production system and systematical improvement, see Figure 25. Hereby the value 0 corresponds to a very low degree of agreement, the value 4 to a very strong agreement. It can be clearly stated that in enterprises, who have no employee suggestion system (ESS), the penetration of holistic production methods like systematical waste analyses or value stream optimization methods and so the strive for operational excellence is less distinct than in organizations with an ESS or similar institution.

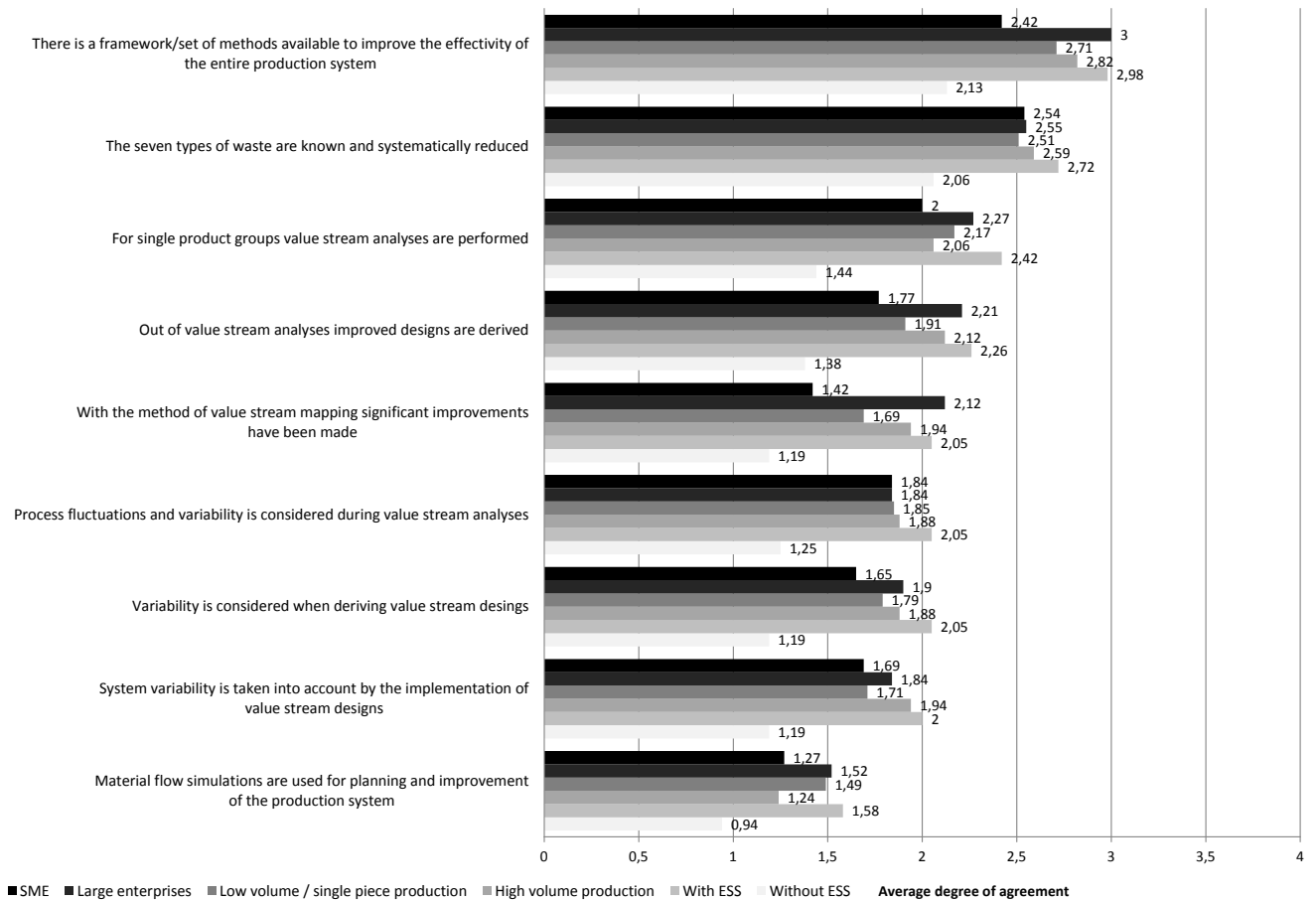


Figure 25: Clustered results in the section production system and systematical improvement (SME: n = 26; Large enterprises: n = 33; Low volume / single piece production: n = 35; High volume production: n = 17; With ESS: n = 45; Without ESS: n = 16 companies)