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CONTINUOUS IMPROVEMENT PRACTICE IN LARGE ENTERPRISES: STUDY RESULTS

Abstract: *Continuous improvement is indispensable for ensuring the company's development and its survival on the constantly changing global market. Continuous improvement is particularly important in the quality and production management systems. A company should deliver a product compliant with a client's requirements in a specified time and at an appropriate price. That is why, continuous improvement refers to different areas of an organization's functioning and it is an integral part of Lean Manufacturing. This article presents the results of the study conducted in production enterprises on a limited area. The aim of the study was the assessment of the implementation of continuous improvement in Lean Manufacturing, and, in particular, employees' involvement in the problem identification and in reporting improvements as well as the way of motivating employees to involve themselves. The authors also tried to identify the factors influencing the elements of a continuous improvement system.*

Keywords: *lean manufacturing; continuous improvement; employees' engagement; large enterprises*

1. Introduction

Continuous improvement and innovative solutions development are the basis for ensuring the companies' development and their survival on the global market. Regular changes introductions are forced by the market. It concerns products or services offered as well as a work organization itself (Tanninen *et al.*, 2011).

All the areas of an organization's functioning beginning with a product or services design, through the production organization and execution, ending with the delivery to a client should be considered as areas for continuous improvement application (Godinho Filho and Uzsoy, 2010).

A company shouldn't forget about supportive processes such as the technological machine park management, which also should be subject to the process of continuous improvement (Maletic *et al.*, 2012).

Continuous improvement is the basis of all quality management systems and Lean Manufacturing, where it is known under the name of Kaizen, and it should be the basis of all organization's management systems as well as it should support the organization in

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achieving its objectives (Salah *et al.*, 2013), (Lepmets *et al.*, 2012). Other form of improvement implementation is Kaikaku, which is much more difficult and resources consuming (Radenkovic *et al.*, 2013).

To motivate employees to continuous involvement, reporting problems and suggestions for their solution companies apply different systems. Such systems are designed and customized to the needs of the specific enterprises (Tervonen *et al.*, 2012), (Marin-Garcia *et al.*, 2008). The results of continuous improvement are more and more often measured by means of different indicators (Muthiah and Huang, 2006). That gives the possibility for a company to realize the benefits of continuous improvement.

To support the employees' engagement related to the continuous improvement the companies often use different IT systems, including the one suggested in the paper (Unver, 2013). Such systems are a good source of knowledge on the improvements applied, and inspire employees in a company to develop new improvements. It can be said that gathering knowledge is the bases of organizational improvement (Łukasinski, 2013).

Continuous improvement has the impact on the organization's financial outcome, especially on quality costs, what was the object of previous studies (Kim and Nakhai, 2008). Hoverer, some authors underline the fact that not all the continuous improvement programmes may bring real business benefits. This situation is defined by Keating et al. in (Keating *et al.*, 1999) as the improvement paradox.

It is not so easy to implement continuous improvement but there are factors which enable continuous improvement (García *et al.*, 2013) and such which inhibit improvements implementation (Garcia-Sabater and Marin-Garcia, 2011). In published works authors indicate how to overcome failures related to the continuous improvement (Wu and Chen, 2004). In the work (Holtskog, 2013) the author points out that the success of the continuous improvement programme in a company has a cultural foundation and that even the companies of the same industry may achieve completely different results. In the work (Terziovski and Sohal, 2000) authors underline that the motivation of the employees' involvement is greater when a company achieves better effects that result from the continuous improvement programme implementation.

However, this article focuses on the assessment of the ways of motivating to continuous improvement and a real implementation of the continuous improvement programme. The study was conducted in large enterprises which, according to the authors and some previous studies (Bhasin, 2012), should possess the most developed Lean Manufacturing systems based on continuous improvement.

2. Study subject and methodology

The mail goal of this paper was to assess the implementation of the continuous improvement process in large companies. The study was conducted in companies operating in the area of podkarpackie voivodeship in Poland. The study concerned production companies. The study areas with detailed information of studied elements are listed in table 1. The study was started in 2010. That time 152 618 enterprises were registered in the region of podkarpackie voivodeship, Poland. 202 enterprises were registered as large enterprises (data from the Marshal's Office of podkarpackie voivodeship, Department of Strategy and Planning). For the purpose of study conducting the enterprises were categorised according to the following categories for population identification: industry and production types. 150 enterprises were invited to take part in the study. Any enterprise, plant or its department that had its own strategy and was accounted of its accomplishments could be the object of the

study. 46 questionnaires were obtained as a feedback.

Table 1. Study areas.

Study area	Detailed goal of the study	Element studied
Team work	Level and areas of team work implementation	Team work implementation
Workers' involvement	Level and ways of workers' involvement in the continuous improvement process	People involved in continuous improvement Forms of involvement Forms of reporting problems People involved in the problem solving in production processes
Motivating workers	Level and ways of motivating workers	Forms of rewarding workers for the improvements implementation
Improvements	Level of improvements implementation	Areas of the improvements implementation A number of improvements

The study had a form of interviews. The subjects of the study were the representatives of a medium and top management, but also the employees directly responsible for the process of the technological machines and appliances supervision in a company, as well as the chosen machine operators.

The study was conducted with the use of a questionnaire which had a conjunctive multiple choice format and included a list of prepared, provided in advance answers presented to a respondent with a multiple response item in which more than one option might be chosen. Additionally, a respondent could give other, his or her own answers if they were not among the provided options.

3. The structure of the studied enterprises

During the study, the enterprises were classified according to the following criteria: industry type, production type, type of capital and ownership type. Table 2 shows the structure of the studied enterprises. 93% of the studies enterprises are privately owned, the remaining 7% is state owned.
Podkarpackie voivodeship is a specific region of Poland, where many of the companies are associated in an association called Aviation Valley. That is why, 42% of the companies declare that they operate in aviation industry. Both aviation industry as well as automotive industry are very demanding industries so the information obtained can be very valuable.

Table 2. Structure of the studied enterprises

Industry type of the studied enterprises	Production type in the enterprises	Type of capital
Aviation – 42% Automotive – 34% Metal processing – 13% Electric, electronic – 11% Furniture – 8%	Mass – 12% Big-batch – 27% Medium-batch – 18% Small-batch – 22% Piece – 20%	Foreign majority capital - 68% Entirely Polish capital - 17% Polish Majority capital - 15%

Wood and paper – 5% Chemical – 3% Food – 3% Other – 5%	A few types – 6%	

The company could operate in two or more branches and could have two or more types of production.

4. Study results

4.1. Team work and motivating workers

The basis of continuous improvement is team work. Implementation of team work gives the effect of synergy. That allows to achieve more, faster and cheaper solutions of identified problems.

The companies studied were asked if they use, and in what kind of activities they use team work. The study showed that 100% of the studied enterprises adopt team work. Team work is applicable mostly, because in 89% of companies, in problem solving. Both in the process improvement and in the decision-making process, team work is applicable in 74% of companies. Among other uses developing and starting new processes are indicated as realized in team work.

In 67% of the studied companies improvements implemented are rewarded according to a system of rewarding workers. The most common form of motivation is a financial reward (90%). Other forms of incentives are a diploma and the like – 52%, and in kind reward – 26%. Among other (10%) forms of incentives, the following were specified: placing a note in the company newsletter, announcing the information at the briefing or oral commendation of a superior or a president.

4.2. Workers' involvement

As figure 1 shows the most involved in the process of continuous improvement, according to the study results, are the middle and top managers (78%). 70% of companies indicated production managers as an employee group working on improvements implementation. 67% of companies involve production workers and 54% office workers in continuous improvement process. Only 39% of the companies indicate that the company's owners are involved in the improvements implementation process.

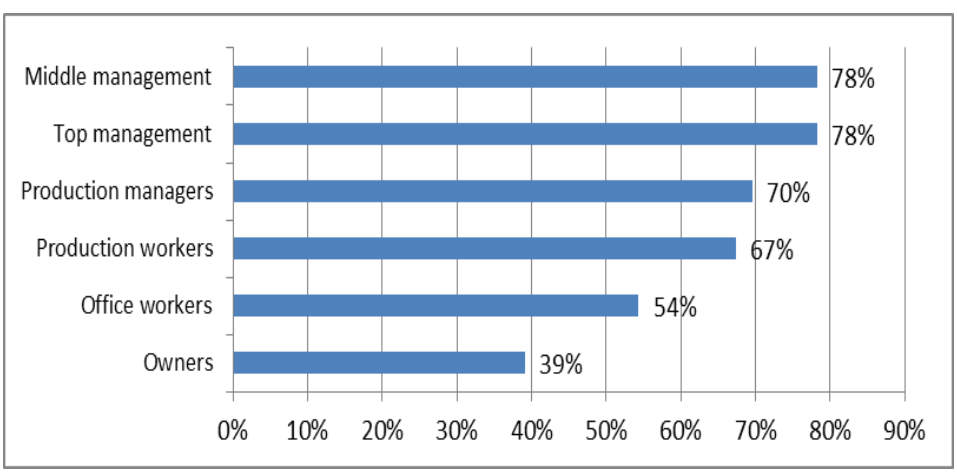

Figure 1. People engaged in the continuous improvement process

The companies indicated different forms of involvement. 89% of companies specified problems reporting as the most common form of involvement. 78% of companies indicated suggesting improvements. That can confirm the employees' ability of problems noticing and creativeness.

72% of companies admit that one of the forms of involvement in the continuous improvement process is participation in the meeting on a problem analysis and seeking its solution. It shows that group work is important in the problem analysis.

Only 41% of the companies admit that workers want to take part in the team activities. It may suggest that there are situations when the workers are forced to work in teams. However 65% of companies underline sharing experience by employees with their co-workers.

As the study shows, 70% of employees express willingness to participate in trainings. These results emphasize the significance of employees' self-development. It is certainly also important for enterprises. That is probably why more and more companies finance employees' continuous training, which takes e.g. the form of external or postgraduate studies.

It is also worth showing that 63% of the companies notice better care of the work places. It can be connected to the more and more known and widespread 5S method.

Among other forms of involvement the respondents indicated the participation in Kaizen and TPM trainings.

Employees report problems in different ways. In 85% of the companies, problems are reported orally to the immediate superior, probably because it is the easiest way. However, if the problem is not registered anywhere how can we be sure that the problem will be solved efficiently and will not reappear.

In 52% of companies reporting problems is realized via e-mails and in 39% with the use of other written forms. 37% of enterprises use IT kiosk for problems reporting. This is a very useful way because the data are directly entered in the company databases, and they are accessible for right people.

28% of the companies use special forms and the box for the forms filled with problems is placed on a board. This way the problems and their solutions can be analysed by more employees and can be a source of knowledge.

Among other ways of reporting problems companies listed the use of a computer system of internal complaints and SMS messaging or recording the information in a shift log.

In 2% of the companies there isn't any form of reporting problems set.

Problems appearing in the production processes are most often solved by the teams appointed to solve a particular problem (67%). It shows that it is very important for employees to have a possibility to work in teams and to work with different people, because, depending on a problem, different people can be engaged in a problem analysis. This fact also emphasizes the role of team work and the significance of knowledge about group work methods.

In 46% of the companies a line supervisor was indicated as a person involved in the problem solving in the production processes. It is probably because he or she has a wider knowledge and experience concerning the production process and authority to make decisions.

In 37% of the companies workers are engaged in problem solving in the production processes. This is a group of employees who know the process in practice and they can easily answer the question about what solution can be implemented practically. Certainly, among the workers there are people for whom there are solutions not enough good. Such people shouldn't be involved in solving the problems of a production process because they create heavy work atmosphere.

The enterprises studied also underline the role of a quality control department in production problems solving, but only 15% of the companies indicate that employees from this department are involved in a production problems analysis.

In addition, in 15% of the cases, there are permanent teams for solving problems.

Among other people involved in the problem solving in the production processes, the following were enumerated:

- Shift supervisor, superior, foreman,
- Different people appointed to solve problems depending on their kind or significance,
- Lean facilitator,
- Foreman together with the services needed; technologist, maintenance services worker, quality worker,
- Technologist, design engineer.

4.3. Improvements

In 90% of the cases improvements regard the organization of workplaces. It shows that probably this is the place where improvements can be implemented in the easiest way.

74% of the enterprises indicate technologies as an area of improvements implementation. Obviously, if a company wants to survive in the today's market it has to develop its technologies. On the other hand, we can notice that 26% of the companies don't improve technologies, and the question is what the reasons for this are.

More than a half of the studied enterprises (65%) admit that they improve tooling constructions. It can be connected to the necessity of faster setups and the implementation of SMED method. 61% of the companies indicate a machine setup as an area for improvements implementation.

Also 65% of the companies improve a production flow. It is usually forced by the market because customers want products faster and cheaper but with the same quality. Because a company can't make savings by buying worse materials it has to look for wastes in a production flow and eliminate the wastes.

Work environment (dust, noise, etc.) and H&S regulations are also the areas for implementing improvements. As we can see in the study results, it is not so important for the companies, because in both areas only 55% of the companies implement improvements.

48% of the enterprises indicate a product construction as an area of development. The question appears why. The answer probably lies in a type of industry in which the studied companies operate and in their authorizations concerning possibilities of the product development. In many cases the studied companies just realize the ordered products on the basis of the received documentation and design.

In the storage of work in a process area companies also see the possibility of improvements (48%). In the process of improving companies are the least interested in improving service and machine maintenance (42%).

Among other areas of improvements implementation, enabling customer service, improving services and introducing additional services were mentioned.

On the basis of the conducted studies we can say that even though continuous improvement is applied, only a few of the improvements are implemented (Figure 2).

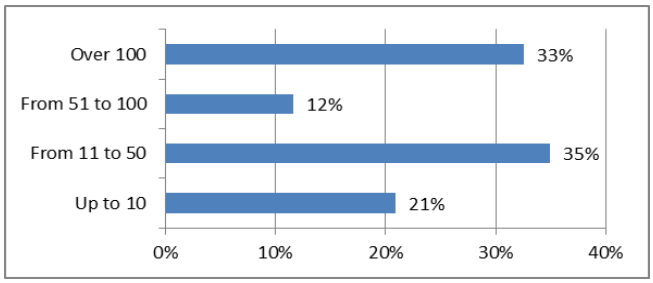

Figure 2. Number of improvements reported in enterprises annually

Only 33% of the companies indicated that they introduce over 100 improvements annually. 21% of the companies introduce up to 10 improvements annually and 12% - from 51 to 100 improvements. However, most of the studied companies (35%) implement from 11 to 50 improvements annually what, in comparison to the companies possessing developed systems of Lean Manufacturing, is a really poor result.

5. Data analysis

For the collected data additional analyses were performed. The goal of the analysis was to assess if there is a statistically justified influence of a production type, industry type, type of capital and situation of the company on the continuous improvement process.

Hypothesis made and results of *Chi²* analyses are presented in Table 3. The analyses were conducted using Minitab 16 program.

Table 3. Hypotheses made and *P-values* obtained.

It.no.	**Hypothesis**	***P-value***
1.	There is no difference in the forms of involvement in a continuous improvement process between the companies possessing different production types	**0,000**
2.	There is no difference in forms of problems reporting between the companies possessing different production types	0,087
3.	There is no difference in employees engaged in problems solving in production processes between companies possessing different production types	**0,008**
4.	There is no difference in areas of improvements implementation between the companies possessing different production types	**0,000**
5.	There is no difference in areas of team work implementation between companies from different industries	0,203
6.	There is no difference in employees involved in a continuous improvement process between the companies from different industries	**0,000**
7.	There is no difference in the forms of involvement in a continuous improvement process between the companies from different industries	**0,000**
8.	There is no difference in the forms of problems reporting between the companies from different industries	**0,004**

9.	There is no difference in employees engaged in problems solving in production processes between the companies from different industries	**0,000**
10.	There is no difference in the form of employees rewarding for implemented improvements between the companies from different industries	**0,000**
11.	There is no difference in the areas of improvements implementation between the companies from different industries	**0,000**
12.	There is no difference in the number of implemented improvements between the companies from different industries	**0,000**
13.	There is no difference in the areas of team work implementation between the companies operating on various types of capital	0,391
14.	There is no difference in the forms of involvement in a continuous improvement process between the companies operating on various types of capital	0,454
15.	There is no difference in the forms of problems reporting between the companies operating on various types of capital	**0,000**
16.	There is no difference in the form of employees rewarding for implemented improvements between the companies operating on various types of capital	**0,000**
17.	There is no difference in the number of implemented improvements between the companies operating on various types of capital	**0,000**
18.	There is no difference in employees involved in a continuous improvement process between the companies in different situations	**0,005**
19.	There is no difference in employees engaged in problems solving in production processes between the companies in different situations	**0,000**
20.	There is no difference in the areas of improvements implementation between the companies in different situations	**0,000**

The conducted analyses show the influence of a production type, industry type, type of capital and situation of the company on the continuous improvement process. Figures 3-20 present graphical results and then their detailed interpretation.

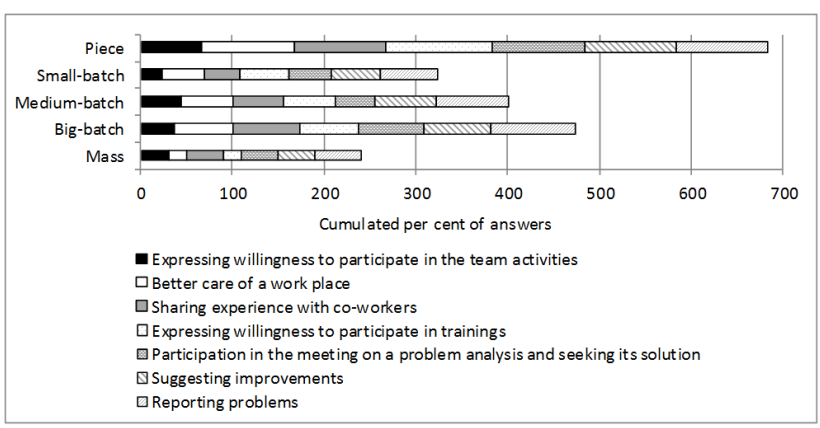

Figure 3. Forms of involvement in a continuous improvement process depending on production types

On the basis of the conducted analyses it can be concluded that the majority of the forms of engagement in a continuous improvement process are implemented in the companies where piece production is realized (Figure 3). All of the analyzed forms of involvement exist in almost all of these companies. It is probably because piece production is connected with continuous changes of produced products, what forces continuous seeking of the best ways of new tasks realization and the necessity of experience sharing. Moreover, in general, the employees in these companies express willingness to participate in team activities.

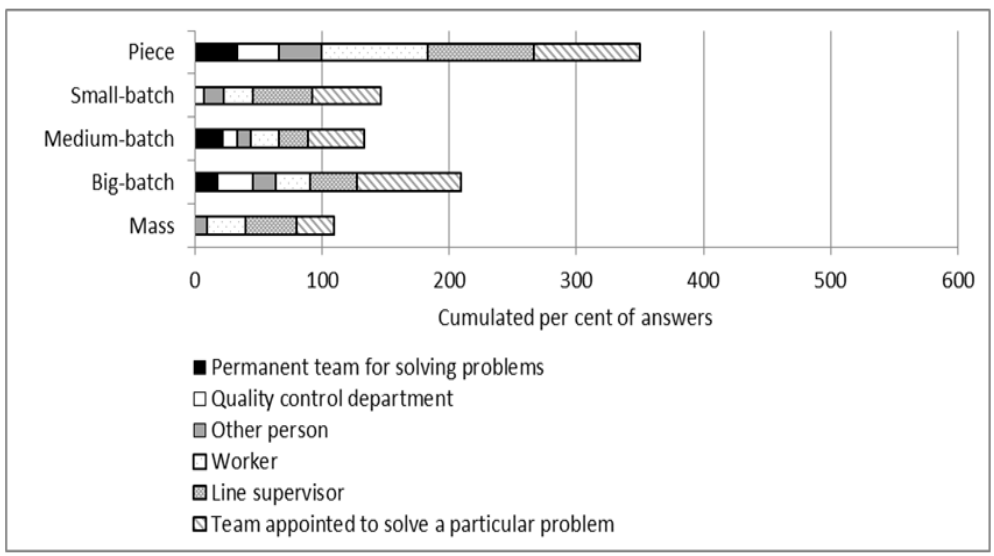

Figure 4. Employees engaged in problems solving in the production processes depending on production types

In the companies where a piece production is realized the most varied group of employees is engaged in problems solving in production processes (Figure 4). It should be also emphasized that none of the companies, which realize mass production has a permanent team for solving problems. What's more, they don't engage the quality control department to solve problems in production processes. Similarly, the companies which realize small-batch production don't have a permanent team for problems solving.

On the basis of Figure 5 it can be said that in all of the mentioned areas the companies implement improvements no matter what production type the company realizes. However, we can notice a significant difference in the number of companies which implement improvements in each area. As we already mentioned, these are also the companies which realize a piece production type and which simultaneously implement improvements in the areas indicated.

From the study results shown in Figure 6 we can conclude that the biggest percentage of companies operating in aviation industry indicate different groups of workers involved in the continuous improvement process. In automotive industry the situation is similar as in other industries. It probably results from the fact that aviation industry is very demanding and engagement in improvements implementation is actually expected from all employees in such companies. It is commonly believed that it is automotive industry where continuous

improvement is emphasized most. However, we can see that in the area of this study it is aviation industry which should be treated as a standard of continuous improvement.

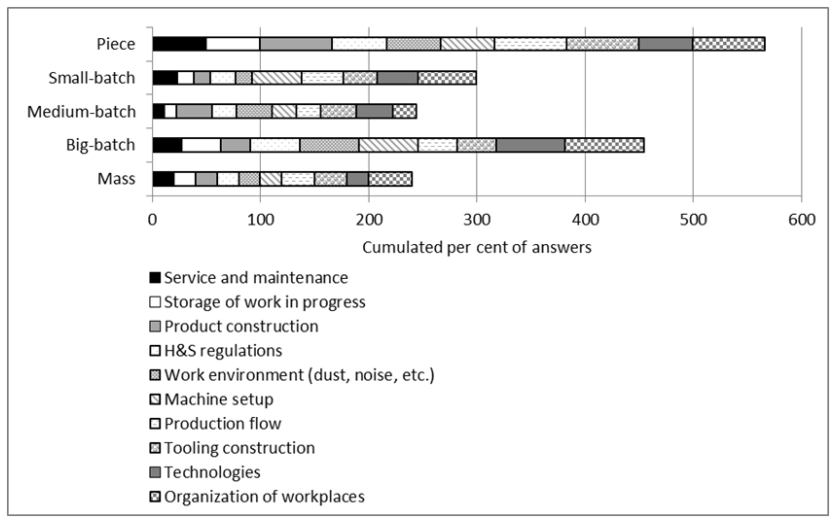

Figure 5. Areas of improvements implementation depending on production types

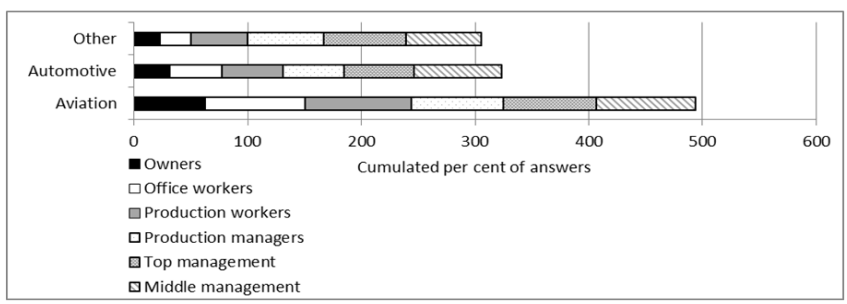

Figure 6. Employees involved in continuous improvement process depending on type of industry

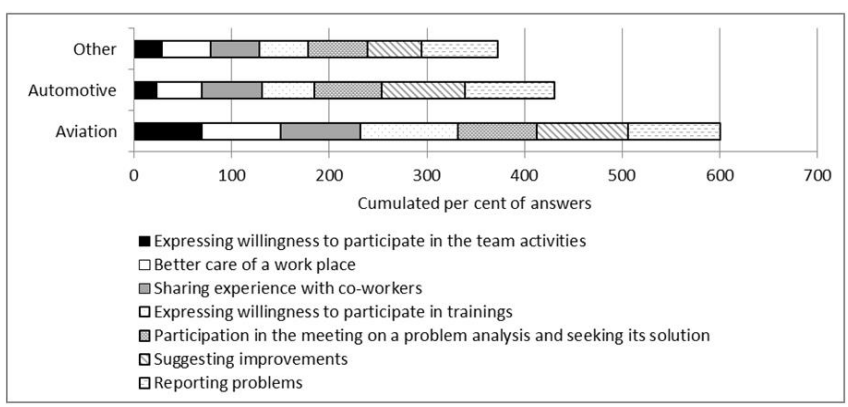

Figure 7. Forms of involvement in the continuous improvement process depending on type of industry

There is a similar situation present in the forms of engagement in the continuous improvement process. In addition, in this case the enterprises from aviation industry prevail. From Figure 7 we can draw interesting information. There is relatively low employees' willingness to participate in the team activities in the studied companies.

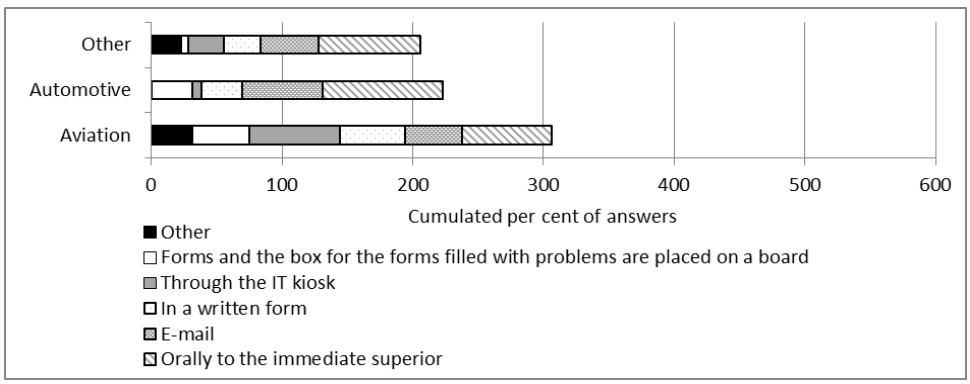

Figure 8. Forms of problems reporting depending on type of industry

On the basis of the results we can say that averagely the companies use two or three forms of problems reporting (Figure 8). However, the collected data results show that there are companies which use all of the specified forms of problems reporting or which use only one form – usually oral problem reporting to the immediate supervisor. In the companies from aviation industry one of the most common form of problem reporting is using IT kiosks, which are situated in different parts of the shop floors. While in automotive industry the most common is e-mailing problems apart from/along with oral reporting.

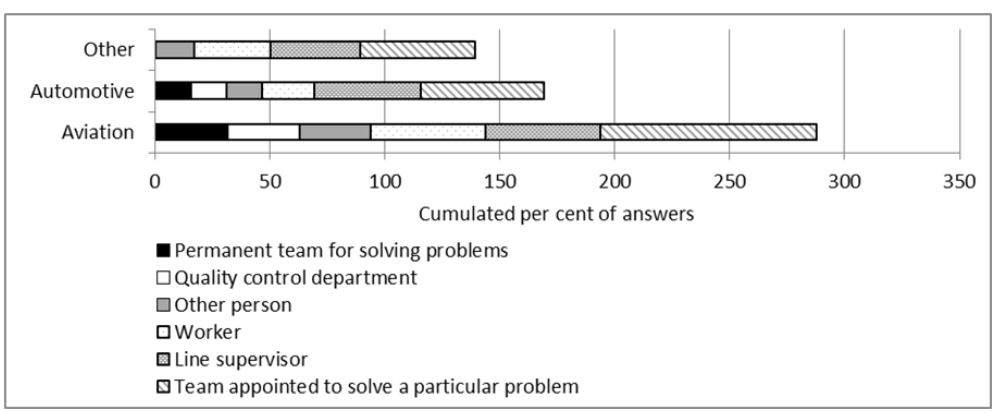

Figure 9. Employees engaged in problems solving in the production processes depending on type of industry

Furthermore, in aviation industry most companies create teams only in order to deal with certain production problems, to analyze them and to implement countermeasures (Figure 9). Then, such team is dissolved to be called again, probably with different members to deal with another problem. At the same time, only in companies from aviation and automotive industry, a permanent team for problems solving exist.

In other industries, as we can see in the study results, there are no permanent teams for problems solving and no employees from the quality control department are engaged in production problems solving.

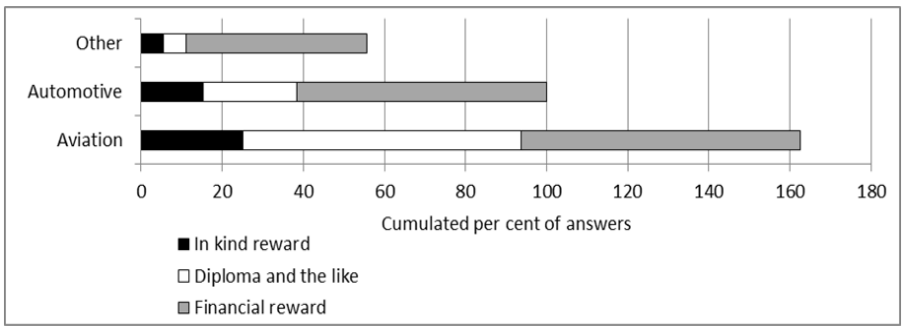

Figure 10. Form of employees rewarding for implemented improvements depending on type of industry

From Figure 10 we can conclude that regardless of industry the most common rewards are financial rewards. However, we can observe that in aviation industry a diploma and the like that are equally important as financial rewards.

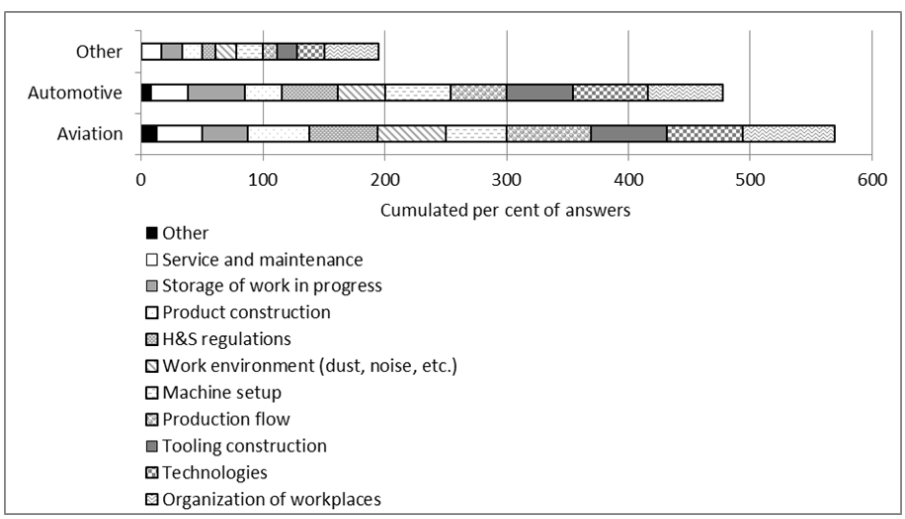

Figure 11. Areas of improvements implementation depending on type of industry

When we talk about areas of improvements implementation the companies from automotive industry are similar to the companies from aviation industry. The similar percentage of the analyzed companies in both industries indicate the same areas in which they implement improvements (Figure 11). In other branches one area of improvements implementation is distinguished – it is the organization of workplaces.

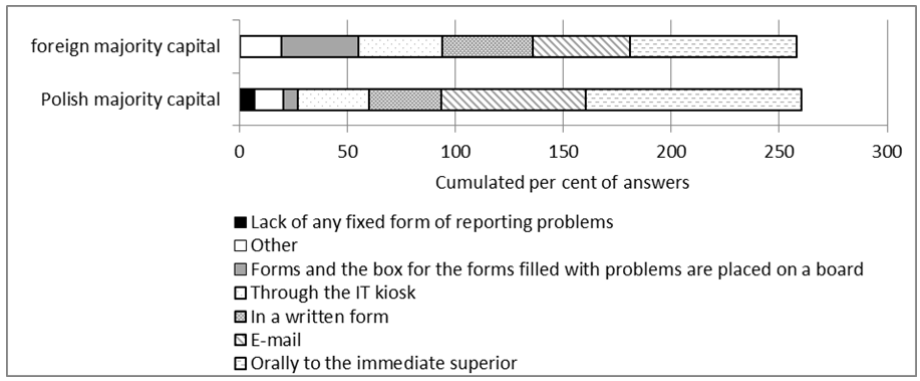

Figure 12. Forms of problems reporting depending on types of capital

Some of the companies with Polish majority capital pointed that they have no fixed forms of problems reporting (Figure 12). In addition, the highest percentage of the companies with Polish majority capital report problems orally or alternatively by e-mail. It means that in these companies there isn't a big pressure to register the problems in order to use the information for further analyses. We can conclude that Polish companies don't appreciate "learning from mistakes".

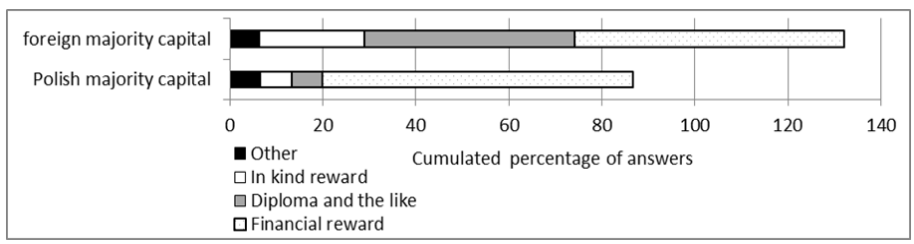

Figure 13. Form of employees rewarding for implemented improvements depending on types of capital

Figure 13 shows that in the companies with Polish majority capital the most important form of employees rewarding for implemented improvements is financial rewards. At the same time, in the companies with foreign majority capital an almost equally important form of workers rewarding is a diploma and the like forms. That is probably because Polish managers and company owners understand better a difficult financial situation of Polish workers for whom money is still the most expected kind of reward.

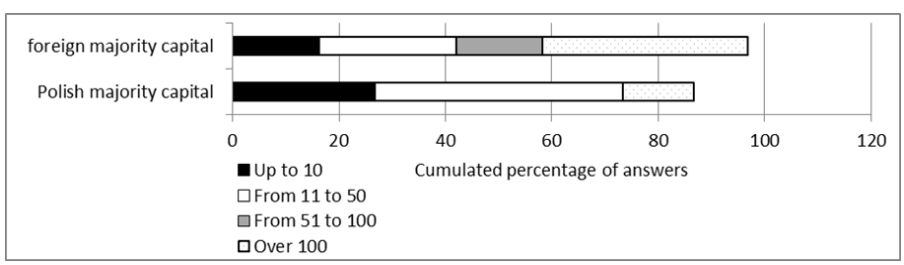

Figure 14. Number of annually implemented improvements depending on types of capital

On the basis of the study results it can be noticed that in the companies with foreign majority capital better effects such as higher number of improvements, are achieved (Figure 14). Thus, we can assume that more efficient continuous improvement systems depend on the forms of employees' rewarding. It was verified in this analysis which confirmed the predictions? A number of implemented improvements depends on motivation system used. Unfortunately, the least number of implemented improvements is achieved in the companies which use only financial rewards as a form of employees rewarding (Figures 15). It only confirms that Maslow's hierarchy of needs should be taken into consideration when establishing an incentive system in a company. Actually, it is not only money that motivates people to involvement.

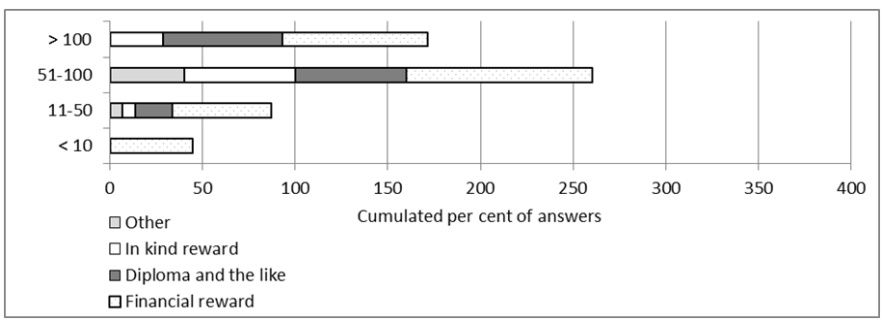

Figure 15. Number of implemented improvements depending on kinds of employees' rewarding for implemented improvements

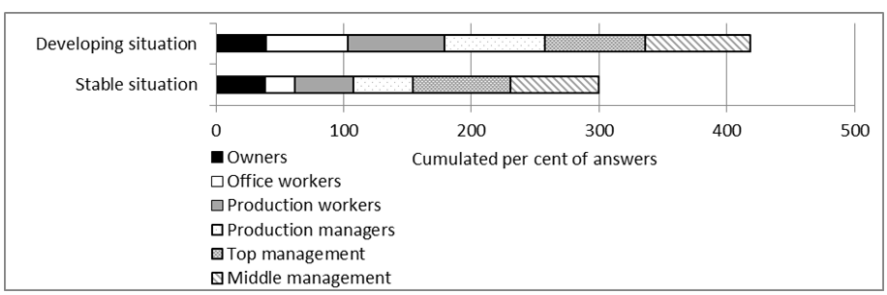

Figure 16. Employees involved in continuous improvement process depending of situation of the company

Figure 16 shows differences between employees involved in the continuous improvement process in the companies in different situations. We can clearly notice that companies which are in a stable situation put less pressure on the continuous improvement process. In such companies these are mostly middle and top management employees who are involved in the continuous improvement process. Moreover, in the field of production process problems solving, these problems are mostly solved by a team appointed to solve a particular problem (Figure 17). In developing companies we can see better engagement of all groups of employees.

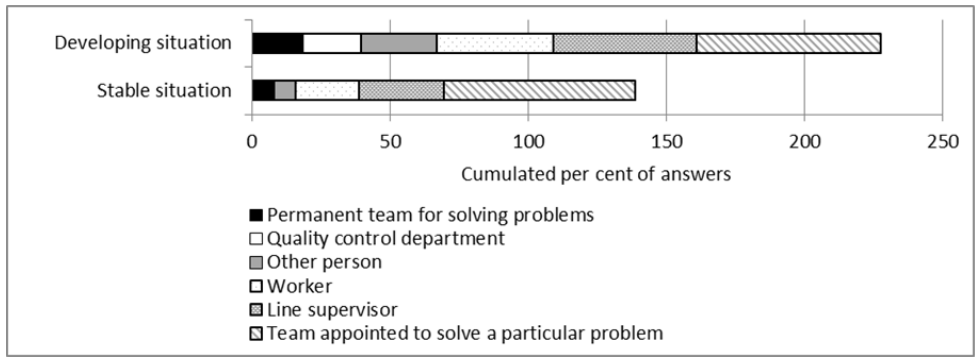

Figure 17. Employees engaged in problems solving in the production processes depending of situation of the company

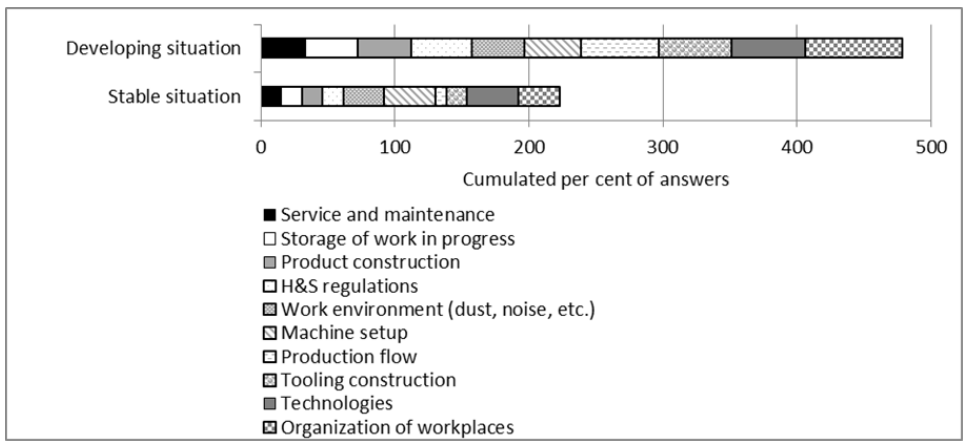

Figure 18. Areas of improvements implementation depending of situation of the company

In the companies which asses their situation as developing this development is noticeable as improvements implementation in all areas in the companies is at almost the same degree (Figure 18). In the companies which asses their situation as stable the minority of improvements is implemented in the production flow area. It is probably because it takes much time and engagement to improve the flow. These companies still implement relatively many improvements in the area of technologies and machine setups. However, it is still considerably less in comparison to the activities taken up by developing companies.

The information concerning the number of implemented improvements is interesting, but the information about the number of improvements proposed by one employee is even more interesting (Figure 19).

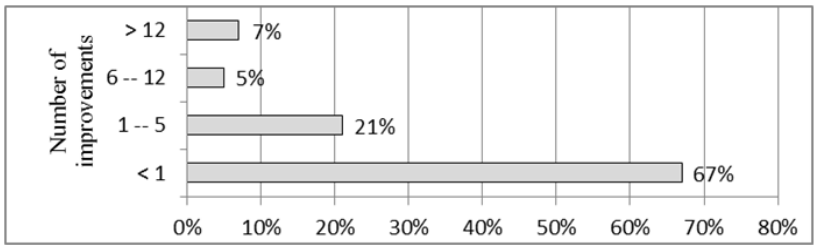

Figure 19. Average number of improvements proposed by one employee annually

As we can see in Figure 19, in most cases, less than one improvement annually is proposed. Only in 7% of the companies employees propose more than 12 improvements what means that one employee propose averagely one improvement a month and that makes quite a good result.

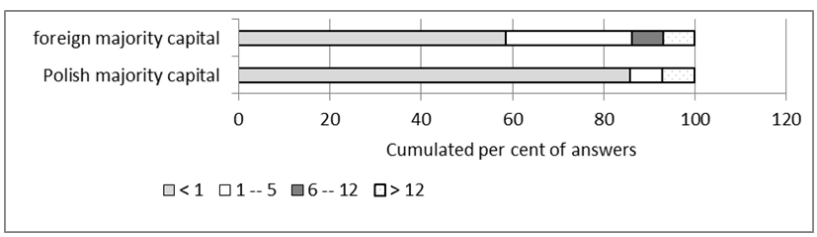

Figure 20. Average number of improvements proposed by one employee annually depending on type of company capital

Regarding the capital of companies, it is easy to notice that these are mostly the companies with Polish majority capital where few improvements are implemented (Figure 20).

6. Conclusions

The conducted studies show that the companies implement in reality the continuous improvement, although it seems that the employees are forced to do it. On the basis of the interviews carried out during the study we can say most of improvement actions are realized under the time pressure. Team work is mostly used in problem solving. This means that these actions are mostly corrective actions taken in place of preventive actions, which should have been taken first. For the reason that one of the most important rules in Lean Manufacturing tells that prevention (Poka Yoke solutions) should go first instead of corrections, problems should be prevented. The engagement mostly of the managers of different levels in a company may indicate that the continuous improvement process is a domain of managers, which is actually not the truth. However, the fact that 67% of the companies tell that in the continuous improvement process production workers are also engaged is comforting. Even though, it is only the case with a little more than a half of the studied companies.

Analysing the form of reporting problems it can be noticed that providing information orally to the immediate superior dominates. It may suggest the employees' reluctance to bureaucracy or a lack of time for registering problems. The most important task is problem solving and, after that, there is no more time for its registration. In consequence, there is no registered information on the basis of which the preventive action could be taken in the area where the problems appeared or in other areas. Thus, Poka Yoke solutions can't be implemented to prevent future mistakes and

problems. The study shows that while creating the system of the continuous improvement companies should put more emphasis on taking action to prevent problems and not to eliminate them, what is unfortunately, the most common way nowadays.

It should be also emphasised that 67% of the companies choose calling a team for a specific problem solving instead of creating a permanent team for solving problems (13%).

It can also be noticed that the main form of motivating workers is a financial reward for the improvements implemented, especially in the companies with majority Polish capital. However, it is worth emphasising that 10% of the studied companies do not use financial rewards to motivate workers, at all.

Additionally, we can draw the following conclusions. Enterprises with majority Polish capital should develop their continuous improvement systems to obtain better results of the improvement process. In particular, it concerns the reward systems of employees for improvements implementation. The system should include, apart from financial rewards, also other forms of rewarding workers. This system initiators should realize that according to Maslow's hierarchy of needs an employee may have different needs in a specific moment of his or her life, and it is not always money what motivates people to engagement. Money is the first need. Next, it is followed by safety, belonging, esteem and finally self-realization. These should be taken into consideration while establishing each incentive system.

Summarizing, the significant role of aviation industry in the studied region should be underlined. The companies from this industry use many good practices in the field of continuous improvement realization. That is why, the systems of the companies from aviation industry should be the object of a detailed study in order to identify good those practices.

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