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Using Six Sigma DMAIC Cycle to Improve Workplace Safety in the Company from Automotive Branch: A Case Study

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The article presents the results of the use Six Sigma DMAIC cycle to improve workplace safety and decrease the cost associated with work accidents in the company from the automotive branch. Selected tools of the DMAIC cycle were used at each stage: the project card and the Pareto-Lorenz diagram at the define (D) stage, the matrix diagram at the measure (M) stage, the Ishikawa diagram with the verification of causes at the analysis (A) stage, the 5WHY method at the improve (I) stage and the c control chart at the control (C) stage. Each of the successive stages was based on the results of the previous one in order to achieve a lasting solution for the analysed problem by the implementation of remedial measures. Because of the implementation of remedial measures, the level of work safety in the examined company was improved. The DMAIC analysis made it possible to identify the main causes (Xn) of accidents at work and to objectively evaluate them in order to discover the root cause (Xn!) of the problem. The root cause turned out to be inadequate protection of the lathe due to the protective cover installed too far away from the lathe chuck, which resulted in the catching of protective sleeves or gloves of the lathe operators and accident events in the form of upper limb damage. The solution to this problem was to reduce the gap between the guard and the lathe chuck by adjusting the guard so that no more items of workers' clothing were caught while the machine was running. The article proves the effectiveness of using the Six Sigma DMAIC cycle in analyzing and improving the state of occupational safety and is an incentive to use this cycle and a specific set of tools to analyze similar problems.

Keywords: quality management, work safety management, risk management, Six Sigma, DMAIC, improvement

1 Introduction

An inseparable element of management is the search for opportunities to improve the organization, increase its efficiency and effectiveness [1, 2]. The need for continuous improvement of the organization is a consequence of continuous and dynamic changes taking place in the environment of the organization and inside it [3]. Introducing continuous improvement to the practice of management means starting the process of building an intelligent and self-improving organization in a continuous manner [4]. The real value of continuous improvement lies in creating an organization that is constantly learning and creates an environment that not only accepts change, but also actually supports it. Continuous improvement can be implemented according to two scenarios - evolutionary, assuming slow improvement of activities, and revolutionary, assuming a radical restructuring of the activity, which scenarios are not mutually exclusive, but may be complementary [5]. Three areas of organizational improvement can be defined: business, processes and contractors [3]. Improving processes includes carrying out the right measurements, drawing conclusions from them and turning them into effective initiatives to improve processes [5]. The subject of continuous improvement of processes is not all processes, but mainly components of economic processes of key importance for the organization [6]. For this reason, organizations undertake pilot attempts to improve processes, which boils down to carrying out projects to improve selected processes of the enterprise.

One of the concepts of continuous improvement of the organization aimed at process improvement, assuming an evolutionary approach to improvement is the Six Sigma method. It is known as a universal method that can be used in any organization [7, 8, 9]. Six Sigma is a highly customer-oriented, formalized, and systematic method that uses highly specialized analytical and design tools, the use of which must be taught to employees [10]. Six Sigma requires equipping employees with appropriate knowledge on the use of methods and tools for the analysis and systematic improvement of the processes in which they are to participate [11]. In the case of improving the existing processes, the methodology referred to as DMAIC (Define-Measurement-Analyse-Improve-Control) [12] is primarily used here. The DMAIC cycle is not limited to Six Sigma and can be used as a base for other process improvement applications [13]. DMAIC solves problems related to defects or failures, deviation from the target, excessive cost, and time [14]. DMAIC can also be used to analyse problems related to safety in the workplace, e.g. to analyse accidents at work [15]. The goal of Six Sigma is to improve the quality of processes by identifying and removing the causes of defects. In relation to safety, the process defects are reflected by unsafe behavior, improper procedures, and equipment failure that can result in injury [16]. Adopting Six Sigma thinking and applying it to workplace safety can help reduce inefficiencies while achieving predictable results [17]. Standardizing safe working practices after the Six Sigma project allows protecting workers from leaving work due to injuries and reduces the time wasted in responding to avoidable emergencies. Six Sigma focuses primarily on the manufacturing aspect of a plant, but using it for improving the safety workplace level can be extremely effective [9].

The aim of the article is to improve workplace safety in the company from the automotive branch by using the Six Sigma improvement cycle called DMAIC. Appropriate tools from the DMAIC cycle were adapted to analyse, evaluate and improve the level of safety in the analysed workplace for the case study purposes. Because the analysed company was incurring high costs related to accidents at work, a decision was made to reduce them by conducting an improvement project according to the DMAIC cycle. The article indicates a possible way of the usage of the DMAIC cycle to analyze not strictly production or quality-related problems, such as work safety problems.

2 State of the art

In the study, a Six Sigma process improvement methodology called the DMAIC cycle was used as the tool to achieve the main goal – improve occupational safety levels in the analysed company. The object of the research was a company from the automotive industry located in Poland in the Silesian Voivodeship producing automotive cables for the Polish and European markets.

Tab. 1 *Key Phases of Six Sigma DMAIC Process [13, 20]*

Phase	Key processes	Examples of methods and tools to be used
Define	– identify the problem according to customer feedback, strategy and mission of company, – define customer requirements, and set goal, – define the project boundaries, – define the process by mapping the business flow.	Project scope, Project charter, Pareto-Lorenz diagram, Business impact, VOC, CTQ tree, Brainstorming, Pareto diagram, SIPOC diagram, Kano Model, Affinity diagram.
Measure	– measure the process to satisfy customer's need, – develop a data collection plan, – collect and compare data to determine issues and shortfalls.	Data Collection Plan, Pareto-Lorenz diagram, Control charts, SPC methods, MSA, Histograms, Checklists, Matrix diagram, Yields (RTY).
Analyse	– analyse the causes of defect and sources of variation, – determine the variation in the process, – prioritize opportunities for future improvement.	5WHY, Regression Analysis, Scatter Plot, ANOVA, DOE, FMEA, Cause and effect diagram, Pareto diagram, Histogram, Process mapping.
Improve	– improve the process to eliminate variation, – develop creative alternatives and implement enhanced plan.	Pugh matrix, DOE, TPM, 5WHY, Poka-Yoke, 5S, FMEA.
Control	– control process variations to meet customer requirements, – develop a strategy to monitor and control the improved process, – implement the improvements of systems and structures.	Control plan, SPC, Visual Workplace, Standard Operating Procedure (SOP's), Mistake Proofing/Zero Defects.

Six Sigma is a measurement-based method for process improvement. Its aim is to improve processes and increase customer satisfaction, both internal & external [18]. Six Sigma is based on the identification and correction of causes rather than effects [19] and has the aim to reduce the variation in processes [20]. Continuous process improvement with low defects and an increase in profitability of the company is the main goal of this concept [21]. Six Sigma by eliminating product or process defects, reduces costs and increases profitability by ensuring stable and capable processes [22, 23, 24]. The concept significantly contributes to improvements in financial and operational performance as well as customer satisfaction by minimizing substandard products and services [25]. In Six Sigma projects, the actions use properly measured data and events as a foundation, but not intuitive decisions or anecdotal solutions [26]. The main elements of Six Sigma infrastructure are the creation of teams to execute projects that strongly contribute to the achievement of strategic goals from the company [19]. Six Sigma is popular in processes that are related to not only production and manufacturing but to IT, healthcare, construction, and many others [7, 8, 9].

The implementation of Six Sigma process improvement projects relies on mainly the DMAIC cycle, based on the Deming cycle [27]. DMAIC cycle is used for quality improvement and problem reduction, mainly for existing processes [20]. The process improvement according to the DMAIC cycle encompasses defining the problem, measuring, then analyzing the data to discover possible root causes, improving the process to eliminate root causes of defects, and sustaining the success over time [10]. DMAIC cycle is used especially for complex problems with unclear root causes or if the risks of inaction are high. It is a sequential cycle but need not be used in strictly linear, phase-by-phase without returns [21]. DMAIC methodology underlines the importance of data collection and analysis prior to its focus on executing problem-solving and improvement initiatives [22]. After the project manager determines the DMAIC and identifies the problem, a project team is called in and a project charter is created that the team should follow throughout the project. This project charter includes the 5 phases of the DMAIC cycle in which specific tools can be used through each DMAIC phase. DMAIC cycle is a flexible cycle that allows for the optimal use of various types of tools and methods [13, 20] at every phase of the cycle as shown in Tab. 1. When applying the DMAIC cycle to the analyzed problem, the selected tools should be used in each phase to analyze and find the root cause of the problem (Xn!). Going through all five phases of the cycle makes it possible to find the root causes of the problem, solve it and develop best practices so that no more problem occurs.

Using the Six Sigma DAMIC cycle allows for identifying the most important elements in the improved process and focusing on the most important causes of problems. Thanks to the DMAIC cycle, it is possible to thoroughly understand the needs of customers perform statistical analysis, and constantly improve the processes occurring in the enterprise [20].

3 Results

In the analysed company, the DMAIC cycle and its selected tools were used to improve the level of occupational safety. The analysed company has incurred high costs related to occupational safety, and specifically the costs related to accidents at work. The management of the company decided to appoint a project team and take steps to reduce them. An improvement project was carried out according to the DMAIC cycle, including five phases:

3.1 Define (D)

In the first DMAIC cycle phase called "Define", the goal of the project was defined by using a specific document - the Project Charter. At this phase, the main problem, current & target state, and expected benefits from the improvement project were defined, and Six Sigma tools to be used were set. The Project Charter (Tab. 2) also included information on project management related to the roles of people involved in the project and the budget.

Tab. 2 *Project Charter*

Topic: *Lowering the ratio of costs related to accidents at work*		*01.07.2020*	
Description of the problem: *the costs of accidents at work exceeded PLN 200,000, which constitutes 3% of sales revenues*			
Expected benefits: a) strategic: *increasing work safety, improving the company's image* b) financial: *cost reduction* c) for internal processes: *increasing the fluidity of processes* d) for customers: *lowering the price of the product* e) for employees: *employee satisfaction, increased remuneration, improved safety at work*			
Current state: *Accident cost ratio 3%*		**Target state:** *Accident cost index max. 1%*	
Other important information: *high accident rate negatively affects the company's image in the environment*			
Team			
Role in the team	**First name and last name**	**Workplace and department**	**Share of commitment**
Project sponsor	*JN*	**Member of the Board**	
Project manager	*LK*	**Department manager**	*25% of full-time employment*
Executive - Green Belt	*SSz*	**Employee - Production Department**	*10% full-time employment*
Executive	*MD*	**Employee - Production Department**	*15% of full-time employment*
End of the project: *30.06.2021*			

In the first DMAIC cycle phase, a quantitative analysis of the causes of accidents at work was also performed using the Pareto-Lorenz diagram, one of the classic quality tools [28, 29, 30]. Thanks to the quality tool, the most important causes of accidents at work were identified, which had the greatest impact on the level of work safety in the examined plant. The Pareto analysis made it possible to organize the causes of accidents at work in terms of their importance, thanks to which it was possible to identify the critical causes that occurred most often and caused the greatest losses. The detection of key work safety problems allowed identifying actions that aim to improve the level of occupational safety, thus reducing the accident rate and reducing costs on this account. Data collected in the analysed company for a period of one year was used to analyse the causes of accidents at work during the production of automotive cable. 307 causes of accidents at work were identified within 1 year. The types of causes of accidents at work are N1 - Ignoring the hazard, N2 - Insufficient concentration of attention, N3 - Improper use of limbs in the danger zone, N4 - Surprise by an unexpected event, N5 - Inappropriate work-ing methods, N6 - Failure to comply with health and safety regulations, N7 - Failure to use protective measures N8 - Performing activities without removing the risk, N9 - Psychophysical state of the employee (consumption of alcohol, intoxicants), N10 - Other (e.g. carelessness, trips). The number of causes of accidents at work has been summarized and the percentage share for each cause has been calculated. The Pareto-Lorenz diagram in Fig. 1 showed the percentage structure of the causes of accidents at work during 1 year. The bars in the Pareto chart show the relative percentage share of each cause of accidents at work, while the Lorenz curve shows the cumulative percentage share of the successive causes of accidents at work. Thanks to the chart presented in this way, it was indicated which causes of work accidents (their symbols in Fig. 1) dominated in the analyzed period, by indicating their percentage share in accordance with the Pareto principle, i.e. the 20/80% rule stating that about 20% of causes generate about 80% of the effects.

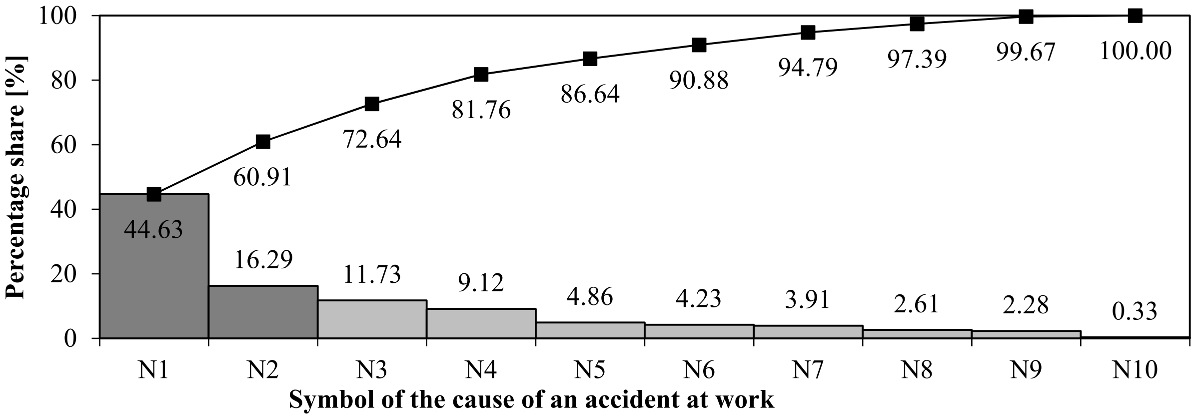

Fig. 1 *Pareto-Lorenz diagram for human causes related to the occurrence of accidents at work in the production of automotive cable*

The prepared Pareto-Lorenz diagram shows that two out of ten causes of accidents at work - ignoring the hazard (N1), the insufficient concentration of attention (N2) (i.e. 20% of all factors) - caused nearly 60.92% of all effects - of accidents in work. In order to reduce the number of accidents at work and reduce the accident rate, the first corrective action decided to eliminate these causes of accidents at work.

3.2 Measure (M)

In the second DMAIC cycle phase called "Measure" a matrix diagram was used, a new quality tool [31] (Fig. 2) to show the relationship between the occurrence of the causes of human accidents at work (%) and their share in costs of accidents at work (%) for a period of one year. The codes (numbers) shown in Fig. 2 correspond to the symbols of causes of accidents at work shown in the Pareto-Lorenz diagram (Fig. 1). The individual quarters of the diagram assigned the following meaning: quarter I: trivial causes (rarely appear and do not result in significant costs), quarter II: bothersome causes (they are not expensive, but visible because they often occur), quarter III: critical causes (often appear and result in significant costs), quarter IV: costly causes (rarely appear, but result in significant costs).

Due to the cost of accidents at work, the first factors that need to be addressed are factor 1 - ignoring the hazard and factor 2 - the insufficient concentration of attention. Factor 1 occurred most times in the enterprise and generated the cost amounted to PLN 50,000, i.e. 34.25% of the total costs. Because of Factor 2, the company incurred costs of PLN 30,000, which accounted for 20.55% of all costs. In quarter 3 there was only factor/cause 1 - ignoring the hazard. This cause was considered - in accordance with the criteria adopted above - as critical which should be minimized in the first place.

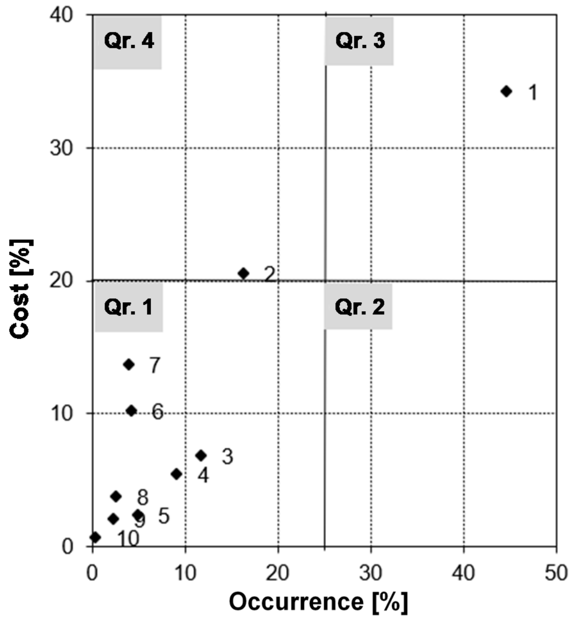

Fig. 2 *Matrix diagram - a summary of the frequency of occurrence of the causes of accidents at work and the costs incurred*

3.3 Analyse (A)

In the third DMAIC cycle phase called "Analyse" - Ishikawa's cause and effect diagram [32, 33] was used based on the 5M + 1E principle for the most common accidents at work, such as injuries to the upper limbs of lathe operators. A team consisting of two lathe operators, a production manager, and a health and safety specialist was established to analyse the causes of this main problem. The main six groups of causes of the accident were identified and the main causes were identified by brainstorming. Team members were asked questions: What? Who? Where? When? Why? and How? Successively, each cause was assigned from the least important, farthest from the horizontal axis, to the most important ones, which were placed closer to the axis on the Ishikawa diagram. Fig. 3 presents a graphical order of interrelationships of the causes that cause the problem of upper limb injuries.

The use of the Ishikawa diagram allowed for associating causes with effects and assigning them to root causes. The problem's causes were organized in order to obtain transparency and communication and with the aim to further analysis. Indication of the location of accidents at work and their potential causes allowed for a detailed diagnosis of the problem under study, before the actual identification of its root causes. In the next stage, the 5M + 1E Cause Verification Tool (Tab. 3) was used, and based on it was analysed all indicated causes of the problem included in the Ishikawa diagram.

Tab. 3 *5M + 1E Causes Verification Tool for the work accident case - injured upper limbs*

		Dominium:	**5M+E VRIFICATION**		
		Machine/Line:			
		Data: 14.07.2020			
		Analysis team:		**Kaizen No:**	
The name of the problem being attacked: *Injured upper limbs*					
VERIFICATION OF POTENTIAL CAUSES IN 5M+E ANALYSIS					
ID	**POTENTIAL CAUSE**	**VERIFICATION ACTION**	**RESPON-SIBLE**	**DEAD-LINE**	**STATUS**
A1	Age of the machine	Checking the date of manufacture of the machine	JN	15.07.20	OK
A2	No security	Checking if the machine has protection	JN	15.07.20	OK
A3	Inadequate security	Checking the operation of security	JN	15.07.20	NOK
A4	Sharp edges	Check the sharpness of the edges	JN	15.07.20	OK
A5	Bad electrical condition	Checking the condition of the electrics	JN	15.07.20	OK
A6	Bad mechanics	Checking the condition of mechanics	JN	15.07.20	OK
B1	No health and safety training	Checking whether employees have undergone training	JZ	15.07.20	OK
B2	No on-the-job training	Checking whether employees have undergone training	JZ	15.07.20	OK
B3	No instructions	Checking if there are any instructions at the workplace	MZ	15.07.20	OK
B4	Inadequate instructions	Checking the correctness and clarity of the instructions	MZ	15.07.20	OK
B5	No personal protective equipment	Checking if security measures are in place	SK	15.07.20	OK
B6	Inadequate personal protection measures	Checking if the protection measures are well selected	SK	15.07.20	OK
C1	Badly chosen material	Checking the correctness of the selected materials	SK	15.07.20	OK
C2	Poor quality material	Checking the quality of processed materials	SK	15.07.20	OK
D1	Use of stimulants	Verification	MP	15.07.20	OK
D2	Stress	Stress level measurement - survey	MP	15.07.20	OK
D3	Tiredness	Fatigue level measurement - survey	MP	15.07.20	OK
E1	Mobbing	Survey questionnaire	MP	15.07.20	OK
E2	Fear	Survey questionnaire	MP	15.07.20	OK
F1	Inadequate lighting	Checking the lighting level	MP	15.07.20	OK
F2	Too much lighting	Checking the lighting level	MP	15.07.20	OK

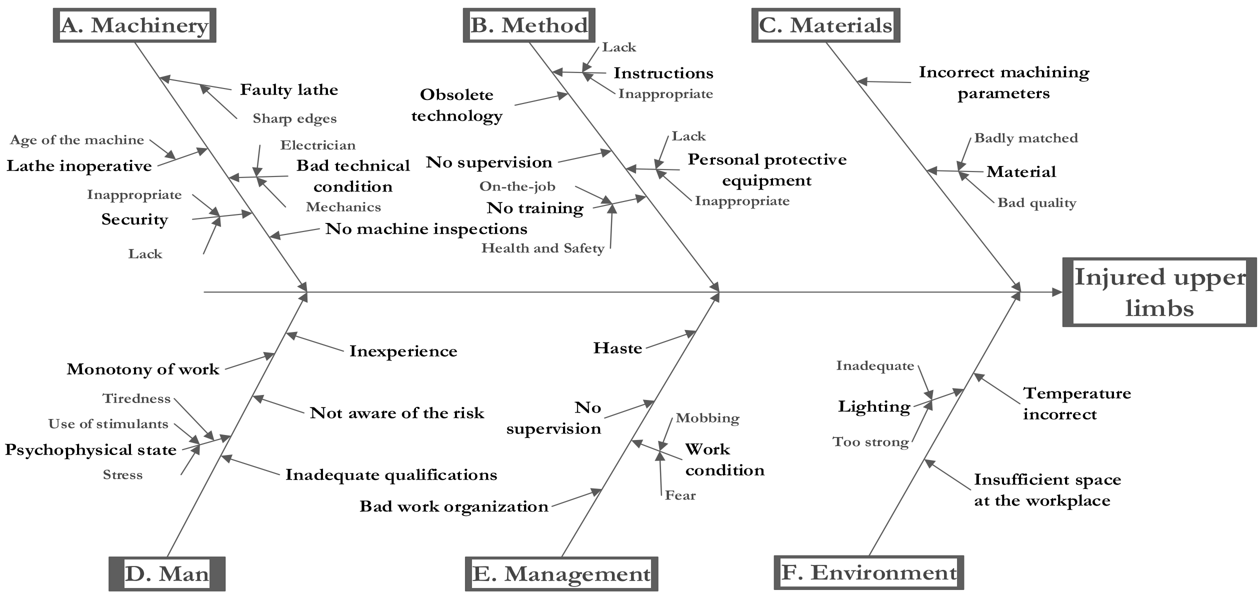

Fig. 3 *Identification of the causes of an accident - injured upper limbs - using the Ishikawa diagram based on the 5M+1E principle*

3.4 Improve (I)

In the fourth DMAIC cycle phase called "Improve", the 5WHY method [34, 35] was used (Fig. 4). The purpose of the 5WHY analysis was to determine the real cause of the problem, which was inadequate security of the lathe, which has been positively verified (obtained NOK status, so the cause truly influenced the problem studied) with the use of the 5M + 1E Causes Verification Tool.

The actual cause of the problem of inadequate lathe protection, after the 5WHY analysis, was the incorrect mounting of the guard. In order to eliminate the occurring injuries of the upper limbs, a target action was taken in the form of shifting the existing cover by 3 centimeters to the left. This remedial action reduced the gap that was visible between the chuck and the guard. This also prevented catching the long sleeves of workers' clothing or protective gloves. The specified solution was implemented at all positions in the line of lathes. Because of these corrective actions, the number of accidents caused by components in the lathe chuck was reduced. Two weeks after the lathe modernization, data was collected and complete elimination of snagging accidents was reported.

5WHY	**Problem:** Injured upper limbs	**Form N°:** 1/2020	**Line:** Production - line of lathes	**TO N°:** XYZ	**Lider:** JN

Start date: 14.07.2020	**Standstill time:** 50 min **Repair time:** 20 min	**Anomaly classification:** ☐ Occasional ☑ Chronic	**Potential Benefits:** Elimination of upper limb injuries	**End date:** 16.07.2020

Problem (description, sketch, diagram)	1. WHY?	2. WHY?	3. WHY?	4. WHY?	5. WHY?	Verification	Action: Temporary:	Action: Target:
Inadequate security	Wrong material of the cover	Strength too low				OK		
		The cover has a design flaw				OK		
		Incomplete cover				OK		
		Cover damaged				OK		
	The cover is not fitted properly	Installed in the wrong place	Too far from the lathe chuck			NOK		Attaching the shield 3 cm to the left to the lathe chuck
		Inadequate mounting				OK		
	Improperly conducted maintenance	Mechanical damage due to improper disassembly and assembly during inspections	No assembly / disassembly procedure			OK		
			Failure to follow the procedures			OK		
			Inappropriate worker inspecting the machine	Lack of abilities	No training	OK		

Temporary actions:

N°	Intervention	Data	☺/☹
1	-	-	-

Target actions:

N°	Intervention	Data	☺/☹
1	Mounting the guard closer to the chuck on all lathes of this type	17.07.2020	☺

Results:
In all modernized lathes on the line, no injuries to the upper limbs caused by being caught by the lathe chuck were recorded within a month

Fig. 4 *The 5 WHY method as a tool for searching for the root causes of the critical work accident - injured upper limbs and for indicating remedial measures*

3.5 Control (C)

In the last, fifth DMAIC cycle phase called "Control" in order to supervise and control the effect of introducing remedial actions after the "Improve" phase, monitoring of accidents at work in which employees suffered an injury that resulted in absenteeism for more than 7 days was applied. For this purpose, an attribute control chart called c chart, one of the SPC tools was used [36, 37, 38]. The sample size was constant, as the number of employees and working hours did not change in the following months. This was a necessary condition for this type of control chart.

The c control chart for the number of accidents at work was presented in Fig. 5.

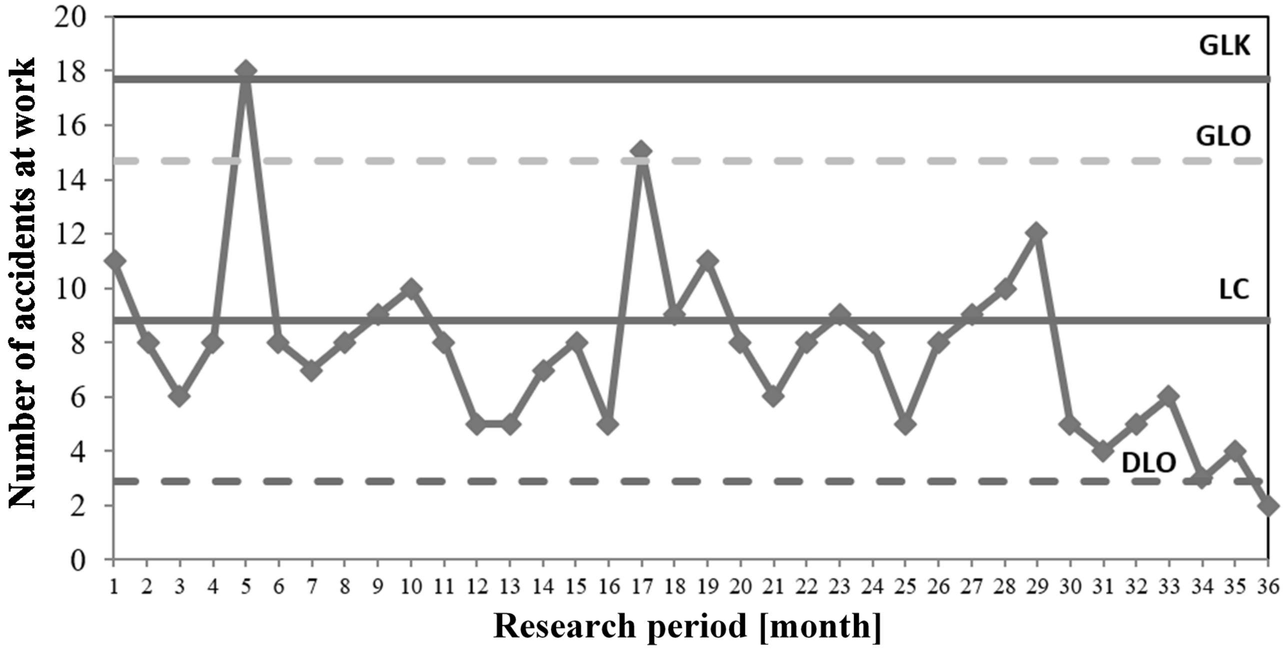

Fig. 5 *C control chart to assess the stability of the number of accidents at work in the following months*

Where:
DLO…Lower warning line,
LC…Central line,
GLO…Upper warning line,
GLK…Upper control limit

The numbers of accidents at work recorded in the next two years were entered directly on the c control chart (Fig. 5). A downward trend in the number of accidents can be observed. In the 35th month, the lower warning line (DLO) has been exceeded. From the 29th month, i.e. from the moment of introducing the improvement actions after the 5WHY analysis, this number decreased below the central line, therefore it can be assumed that the accident rate has been permanently reduced.

4 Conclusion

The article presented the results of the use of the Six Sigma DMAIC cycle in order to analyse, assess and solve the problem of accidents at work in the production of automotive ropes, and reduce related costs. DMAIC cycle was used to identify the main causes (Xn) of accidents at work in analysed company and to objectively evaluate them in order to discover the critical root cause (Xn!) of the problem. The article showed the effectiveness of the application of the Six Sigma DMAIC cycle in improving the level of work safety in a company producing automotive cables. Conducted DMAIC analysis has shown that the root cause of accidents at work in the production of automotive ropes was inadequate protection of the lathe resulting from the protective cover installed too far away from the lathe chuck. It was identified that too far placed the cover caused the existence of a "gap" through which the sleeves or protective gloves were caught, i.e. elements of protective clothing of employees - lathe operators, which in turn resulted in accidental events in the form of upper limb damage. It was proposed the solution to this problem was to reduce the gap between the guard and the lathe chuck by adjusting the guard so that no more items of workers' clothing were caught while the machine was running. After the implementation of corrective action, it was shown that the level of work safety in the examined enterprise was improved. The company, with the help of continuous monitoring of the obtained results, and their constant analysis with SPC tools, strive to constantly reduce the number of work accidents. The target is zero accidents at work every day of the month. To achieve this, the company tries to create an appropriate safety climate and culture [39], demonstrating its management commitment to activities aimed at increasing the level of safety in the workplace and actively engaging as many employees as possible in these activities. The aim is to ensure a high safety level that allows the company to carry out its processes in a smooth manner without unnecessary interruptions [40] caused by accidents.

From the case study of the use of the DMAIC cycle to improve the level of work safety in the analysed company, the following cognitive and functional conclusions can be drawn:

- the Six Sigma DMAIC cycle can be used in an effective way to solve all kinds of problems in companies, not only complex, complicated, production & quality problem cases, but also work safety-related, thanks to a methodical and structured approach to the analyses of a given type of problem using the knowledge and potential of employees strictly related with the nature of the problem,
- the Six Sigma methodology and the DMAIC cycle required the employees of the analyzed company to know the possibilities of using various types of tools, including statistical tools, which involved the necessity to conduct a number of training courses in this field and was time-consuming and costly. This stage cannot be omitted in the effective implementation of the DMAIC cycle in any organization,
- the Six Sigma DMAIC cycle should generally be treated as a flexible cycle of improvement that enables, through the use of the best in the given case "tailor-made" tools, an in-depth analysis of problems from various areas in the company, including work safety problems,
- the use of advanced statistical tools in a given phase of Six Sigma DMAIC is not necessary for the success of this analysis, which showed analysed case study. The use of advanced statistical tools should be dictated by the nature of the problem, its complexity, and specific need related to the need for in-depth data analysis in order to discover the correlation between many different factors and variables affecting a given problem when these dependencies are not visible when conducting the less advanced statistical analysis,
- simple DMAIC cycle tools from each phase based on the search for dependencies in data and causal factors can be effective in finding the root causes of a given problem and contribute to the effective use of the DMAIC cycle for process improvement purposes,
- the efficient use of the Six Sigma DMAIC cycle and its effectiveness (analysis time, costs) depends on the type of problem and its complexity,
- methodical problem analysis based on the classic, less complicated to use PDCA cycle may be a simpler alternative to the more advanced Six Sigma DMAIC cycle that requires more knowledge and effort from employees. The author recommends that company managers use the PDCA cycle first, before actually using the DMAIC cycle in the improvement process.

Summarizing, owners and managers of companies should always remember that all employees come to work to, above all, work safely there. Ensuring safe working conditions should be the most important task of every employer. A thorough analysis of each case of an accident at work in order to find its root cause is necessary to eliminate the safety risk situation from workplaces once and for all. For this purpose, the Six Sigma DMAIC cycle can be effectively used, as shown in the article. It should also be emphasized that in order for the analyzed company to be able to create a completely injury-free workplace, it is necessary to develop a safety strategy that will lead it towards world-class safety results [41]. The proof of the involvement of the management and employees of the analyzed company in the Six Sigma program and the DMAIC cycle presented in the article should be treated as the key to the continuous improvement of the company and development of a safety culture and the creation of a learning organization.

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