THE STAGES OF IMPLEMENTING THE ”KAIZEN IN 2 DAYS” METHOD IN A PRODUCTION LINE

Gheorghe Marius VOICULESCU [1], Emilia BĂLAN [2]

Rezumat. *Pentru compararea în mod direct a nivelului realizării obiectivelor necesare menținerii întreprinderilor componente a multinaționalelor, a căror activitate se desfășoară în mai multe țări, într-o piață competitivă, se folosesc trei criterii, și anume: performanța întreprinderii, gradul de robotizare și implementarea principiilor filosofiei Kaizen. Aceste criterii sunt în strânsă concordanță. Având în vedere principiile filosofiei Kaizen, în această lucrare sunt enumerate etapele implementării metodei „Kaizen în 2 zile” într-o linie de producție din industria automotivă. De asemenea, sunt prezentate exemple de proceduri utilizate pentru fiecare etapă în cadrul organizației în care s-a realizat studiul de caz. În raportul final al derulării șantierului Kaizen sunt detaliate toate acțiunile care au condus la îmbunătățirea procesului de producție și la creșterea performanței întreprinderii.*

Abstract. *To directly compare the level of achievement of the objectives necessary to maintain the enterprises that are part of multinationals, whose activity is carried out in several countries, in a competitive market, three criteria are used, namely: the performance of the enterprise, the degree of robotization and the implementation of the principles of the Kaizen philosophy. These criteria are in close agreement. Considering the principles of the Kaizen philosophy, this paper lists the stages of implementing the “Kaizen in 2 days” method in a production line in the automotive industry. Examples of procedures used for each stage within the organization where the case study was carried out are also presented. In the final report of the implementation of the Kaizen site, all the actions that led to the improvement of the production process and the increase of the performance of the enterprise are detailed.*

Keywords: Kaizen in 2 days, stages of implementing, examples of procedures, automotive industry

1. Introduction

In order to directly compare the level of achievement of the objectives necessary to maintain the enterprises that are part of multinationals, whose activity is carried out in several countries, in a competitive market, three criteria are used, namely: the performance of the enterprise, the degree of robotization and the implementation of the principles of the Kaizen philosophy [1].

[1]PhD student, Faculty of Industrial Engineering and Robotics, Robots and Production Systems Department, POLITEHNICA Bucharest, Romania (e-mail: marius.voiculescu@dacia.com).
[2]Assoc. Prof., PhD Eng., Faculty of Industrial Engineering and Robotics, Robots and Production Systems Department, POLITEHNICA Bucharest, Romania (e-mail: emilia.balan@upb.ro).

Performance represents the degree of fulfillment of the tasks that define a workstation occupied by an employee. Performance refers to the contribution that employees bring to the fulfillment of the organization's objectives.

The degree of robotization of an enterprise represents the percentage of the total amount of work that is performed by robots, or the percentage of the total activity that is performed with robotic systems. The degree of robotization in an enterprise directly influences the performance of that enterprise [2].

Kaizen (改善, a Japanese word meaning “continuous improvement”) is a Japanese philosophy that focuses on continuous improvement in all aspects of life. It has also begun to be applied in the business environment, and Kaizen activities continuously improve all business functions, from production to management and from the CEO to the workers on the production lines.

2. The principles of the "Kaizen in 2 days" method

Kaizen is a daily activity, and its purpose is to increase the productivity of each workstation and to ensure optimal working conditions for operators. This is also a process that, if done correctly, removes the heavy and overwhelming work of operators at the workplace and helps them implement various modern technical solutions, identify and eliminate losses in production processes [3].

Kaizen projects can be attended by employees from all levels of a company, from the CEO down, but also external actors when appropriate. The Kaizen format can be carried out individually, by each operator, in the form of a suggestion system or in small or large groups of operators. Groups are often guided through the Kaizen process by a supervisor [4].

The Kaizen methodology involves the execution of activities that produce changes in the workplace, monitoring the results obtained and then adopting and standardizing the new work skills. Large-scale planning and extensive projects schedules are replaced by smaller experiments that can be quickly adapted to new requirements.

2.1. “Kaizen pillars” for continuous performance improvement

Within the enterprises, for the continuous improvement of its performances and for the increase of the quality of the produced products, different solutions characterized by a series of activities were proposed. The grouping of activities in order to achieve certain goals has transformed over time into distinct methods, with characteristic particularities, specific to each industry. These are the pillars through which the principles of the Kaizen philosophy are implemented within the enterprises.

In the automotive industry, among the most frequently used methods are:

- **the 5S method** - **5S** - maintaining a clean and pleasant working environment, but also a motivating, stimulating work climate [5];
- **the value of merit - V.M.** - improving internal communication in the company and staff motivation, by recognizing merits [6];
- **Just in Time - J.I.T.** - elimination of stocks and reduction of production / service delivery time [7];
- **Total Productive Maintenance - T.P.M.** - increasing the availability of technology by reducing the times of failure, repairs, non-functioning, etc.;
- **Kanban method** - monitoring, through markings, of materials or processes, to improve their quality;
- **method 5 "why"** - the analysis carried out to identify discrepancies by successively asking the question "why";
- **the 4 principles of motion economy - NO / ME / DI / FA** - are the basis for identifying and improving workstations and production flows by reducing the number of motions, displacements and the facilitation of operations by the operator in the workstation.

Based on these methods, for each workstation, a series of procedures are drawn up that must be strictly followed by the operators. These are:

- **FOS** - Standard operations sheet;
- **FOP** - Process operations file;
- **SPL** - Workstation standardization.

2.2. Principles of motion economy

Using these ergonomic principles in the analysis of the operations of the workstations or of the analyzed production lines, all the operations that do not bring added value to the operations carried out in the workstations are identified, in order to be able to put into practice improvements of their activity with regard to the 4 ergonomic principles mentioned, namely: NO / ME / DI / FA [8].

NO - Reduce the Number of Motions - refers to the reduction of the number of movements performed, of movements between two operations or of unnecessary movements (Fig. 1).

ME - Perform Motions Simultaneously - refers to performing simultaneous movements, operations performed with both hands at the same time, performing symmetrical operations with the aim of reducing dead times related to working with one hand, thus balancing the activity between the left hand and the right hand during the operation (Fig. 2).

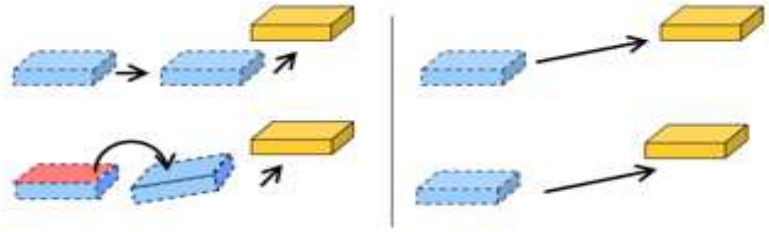

Fig. 1. The NO principle of motion economy.
a. Incorrect; **b.** Correct.

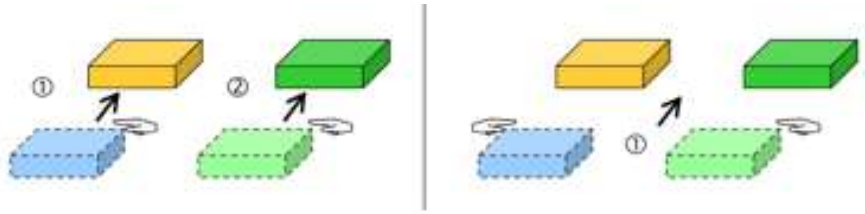

Fig. 2. The ME principle of motion economy.
a. Incorrect; **b.** Correct.

DI - Shorten Motion Distances - refers to the reduction of the travel distances inside the workstation, without trunk, shoulder-arm-forearm movements or to transform a curvilinear movement into a rectilinear movement (Fig. 3).

FA - Make Motion Easier - refers to the ease of carrying out operations, the elimination of factors that restrict movement, the reduction of weights that are handled and promote safety (Fig. 4).

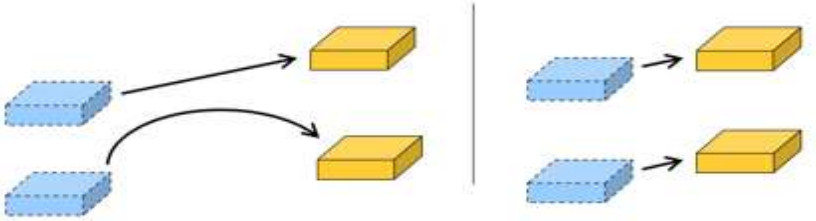

Fig. 3. The DI principle of motion economy.
a. Incorrect; **b.** Correct.

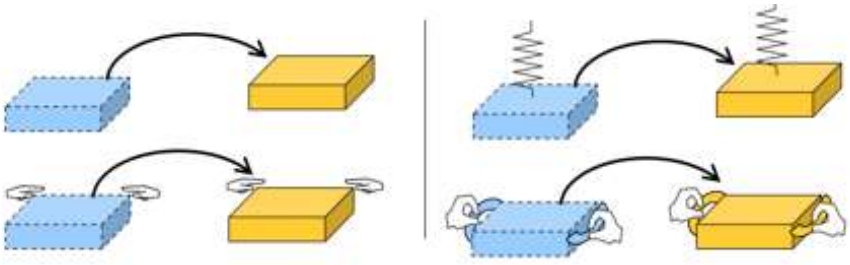

Fig. 4. The FA principle of motion economy.
a. Incorrect; **b.** Correct.

"Kaizen in 2 days" is a method of improving the workplace that requires a sustained activity of a work group and which needs 2 days to put the improvement solutions into practice. In order for the work group discussions to be fruitful and lead to a real improvement of the workplace in 2 days, it is necessary for the participants to be in a positive and open state of mind.

Fig. 5 briefly shows the stages necessary to implement the "Kaizen in 2 days" method (K2) in a production line, and in Fig. 6, the schedule of all activities that will take place for 2 days is mentioned [9].

Fig. 5. The stages of the implementation of the K2 method.

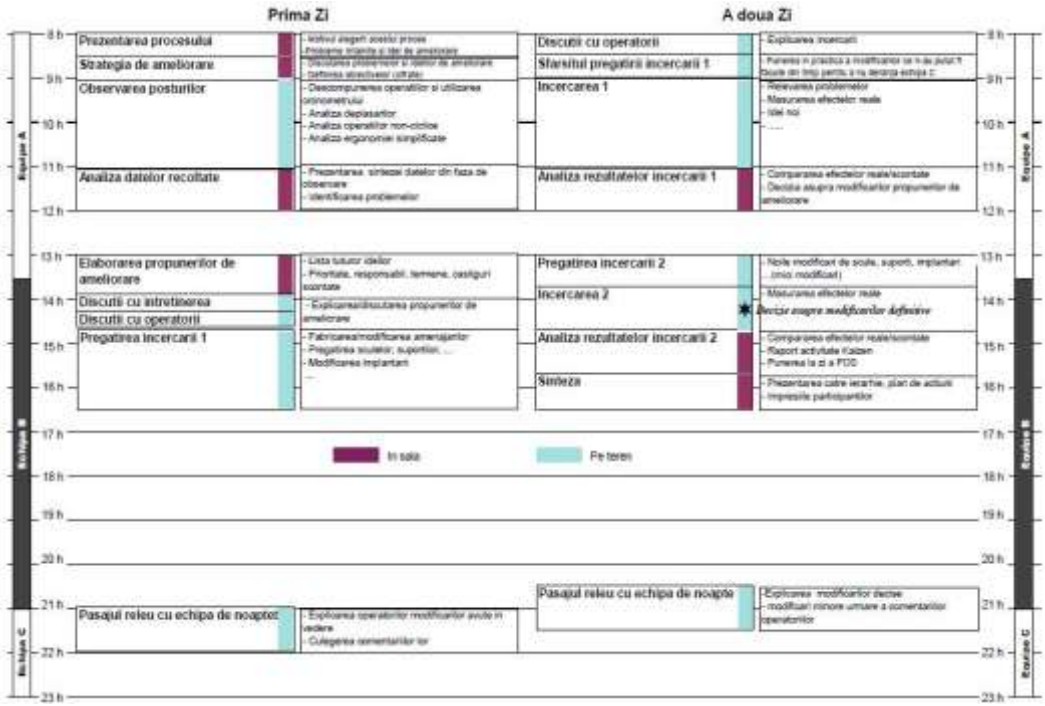

Fig. 6. The schedule of activities specific to the K2 method.

3. The stages of implementing the “Kaizen in 2 days” method

3.1. Analysis of the commitment graph of the workstation of a UEL

For the areas that are standardized from the point of view of SPL (Workstation standardization), the performance graph of the commitment of the UEL (Elementary Unit of Labor) workstations will be presented, after which a global picture of the workload of each individual workstation and the non-value-added times related to these workstations will be created. In Fig. 7 we have an example of the performance graph of commitments from a UEL, specific to the automotive industry.

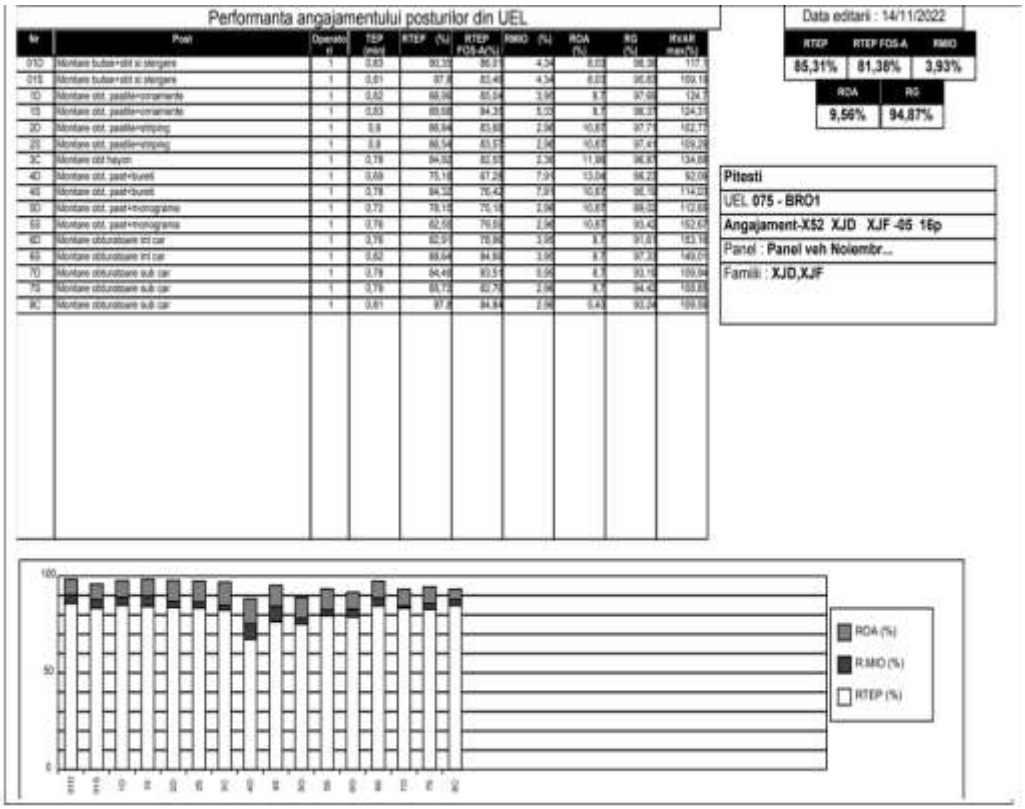

Fig. 7. An example of the performance graph of commitment.

This graph gives a first picture of the distribution of the workload and also from it you can identify the least loaded post, which is usually targeted for suppression. Also in this graph we have the percentage of the value worked both with added value and without added value in each workstation.

After this graphic is presented and explained to the entire work group, they will go to the workstations to verify and clearly visualize the operations in the workstations.

3.2. The report sheet of the observation of losses from workstations

For the analyzed UEL, each observer will fill in the sheet revealing the losses in the workstation, taking into account the 4 principles of the motion economy. Each participant will make a note next to each workstation if they identify deviations regarding non-compliance with these essential principles. In Fig. 8 is an example of a loss observation sheet.

Uzina Vehicule Dacia — Observator : .NASTASE IOANA.
Zona observata :UNITATE CENTRALA B 90 — Data : 05/03/2011.

Foaie de Relevare a Observarii Pierderilor

Tipul de piedere / Secventa operatoare	Miscari: Gesturi Inutile (NO)	Miscari: Gesturi neuniforme (ME)	Miscari: Miscare amplitudine (DI)	Miscari: Pozitie ergonomie Miscari jenante (FA)	Stoc	Producerea de defecte	Operatii fara valoare adaugata	Transport / Manipulare	Inactivitate	Supra-productie	Observatii
OP 1											
OP 2											
OP 3											
OP 4											
OP5									X		SUBANGAJAT
OP 6									X		SUBANGAJAT
OP 7									X		SUBANGAJAT

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Fig. 8. An example of a loss observation sheet.

At the end, the entire work group who has analyzed the workstations will gather in the meeting room and will debate the problems they identified in the workstations and agree on them. All workstations observations for all types of reports and analysis sheets are carried out for a series of manufacturing cycles in order to have the most precise accuracy of the results obtained. If the check is done only for a single manufacturing cycle or by a single person, the results could be inconclusive.

3.3. Analysis of operative sequences

As with the previously presented form, this is also done for all workstations and by several participants, and in it all the operations performed in each workstation will be detailed with the remark of the problem identified and the possible corrective measure for that problem. In Fig. 9 you have an example of the analysis sheet of the operative sequences.


Uzina : .ADSA
Zona implicata : .BF /UNIT C

Participanti :GHEORGHE UNGUREANU NASTASE TIMPLARU.
Data : 05-06/03/2011.

Analiza Secventelor Operatorii

Nr.	Descrierea	Timp	Problema	Masuri corective	Prioritare	Câștig			Pilot	Termen	
						Estimat	Realizat 1	Realizat 2		Termen initial	Termen impus
OP1	SUDARE TUNEL PLANSEU CENTR										
	GUSEU SI TRAV SCAUN										
OP2	SUDARE TUNEL PLANSEU CENTR										
	GUSEU SI TRAV SCAUN										
OP3	SUDARE TUNEL PLANSEU CENTR										
	TRAV SCAUN SI INT LONJ										
OP4	SUDARE TUNEL PLANSEU CENTR										
	TRAV SCAUN SI INT LONJ										
OP5	COMLPETARE SR		SUBANGAJAT	ELIMINARE OPERATOR 6	1	1 OP	1OP	1OP	G.D		X
				PRELUARE +ANGAJARE	1						
OP6	COMLPETARE SR		SUBANGAJAT	OPERATORII 1/2/3/4/5/7							
OP7	COMLPETARE SR		SUBANGAJAT								

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Fig. 9. An example of the analysis sheet of the operative sequences.

3.4. Analysis of the displacements of a workstation

For the UEL or the workstations module, all the movements of the operators will be completed and represented graphically in order to create the overall picture regarding their movement while carrying out the activity in the workstation. These movements, motions counted in the number of steps, will be analyzed and the operations following a Kaizen site will be distributed so that these movements are reduced as much as possible, because each step is counted as 1 lost second. In Fig. 10 you have an example of a displacement report sheet for a stopped or eliminated workstation.

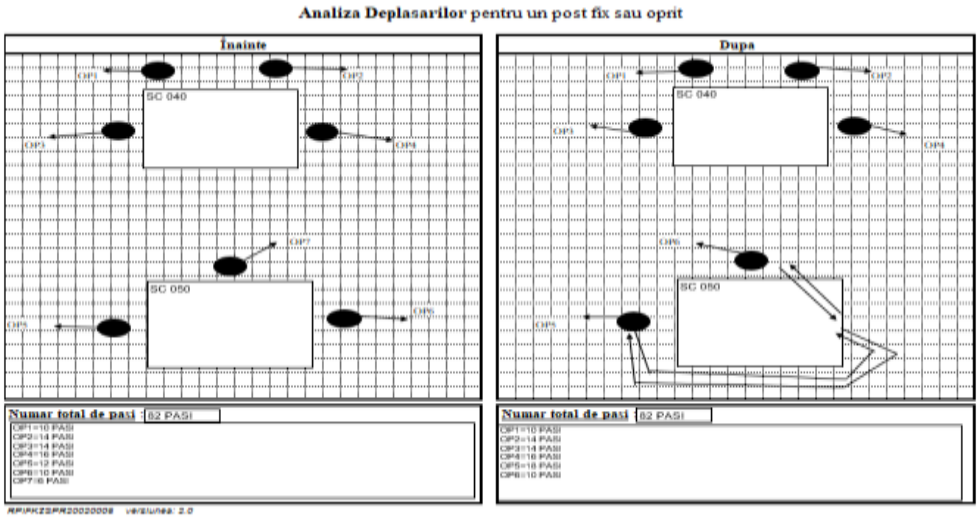


Fig. 10. An example of a displacement report sheet.

3.5. Improvement strategy

In this report form, the current problems, usually with underemployed workstations, will be discussed and the strategy that must be implemented to improve the actual situation, the main actions to be implemented, will be completed. This strategy will be the basis of the tests in the first phases of the Kaizen site to confirm the gains or improvements achieved on the workstation or process. In Fig. 11 is an example of an improvement strategy.

Strategia de Ameliorare

Probleme actuale	Strategia de ameliorare	Obiective cifrate
1 OPERATORI 5 6 SI 7 SUBANGAJATI	PUNERE LA DISPOZITIA DEPARTAMENTULUI A 1 OPERATOR	RH -1 OP
	PRELUARE 7 PUNCTE DE LA OPERATORU 6 DE CATRE OPERATORUL 5	FKE
	PRELUARE 5 PUNCTE DE LA OPERATORUL 6 DE CATRE OPERATORUL 7	
	PRELUARE 4 PUNCTE DE LA OPERATORUL 6 DE CATRE OPERATORUL 2	
	PRELUARE 3 PUNCTE DE LA OPERATORUL 6 DE CATRE OPERATORUL 4	
	PRELUARE 4 PUNCTE DE CATRE OPERATORUL 1 DE LA OPERATORUL 6	
	PRELUARE 3 PUNCTE DE CATRE OPERATORUL 3 DE LA OPERATORUL 6	
		Rezultate
		RH 1 OPERATOR
		FKE

Fig. 11. An example of an improvement strategy.

3.6. Description of the workstation to be improved

In this report form you will find all the actions taken, all the operations that were reassigned with the explanation of where they came from and to which workstation they were reassigned, but also the new graphic diagram of the movements of the operators from the workstations within the UEL. From this report form we have a clear picture of what happened in the workplace from the point of view of the transfer of operations. In Fig. 12 is an example of a workstation description sheet.

3.7. Pursuing corrective measures

In this report form, all the operations or changes that have been undertaken with a well-established pilot related to them and the deadline for advancing the actions and the column for possible remarks will be noted. This report form contains a hierarchical list of all the actions that were taken and who was the person designated to carry them out. Knowing them has an essential role in the development of the Kaizen site and the monitoring of the achieved results. In Fig. 13 is an example of a table for tracking corrective measures.

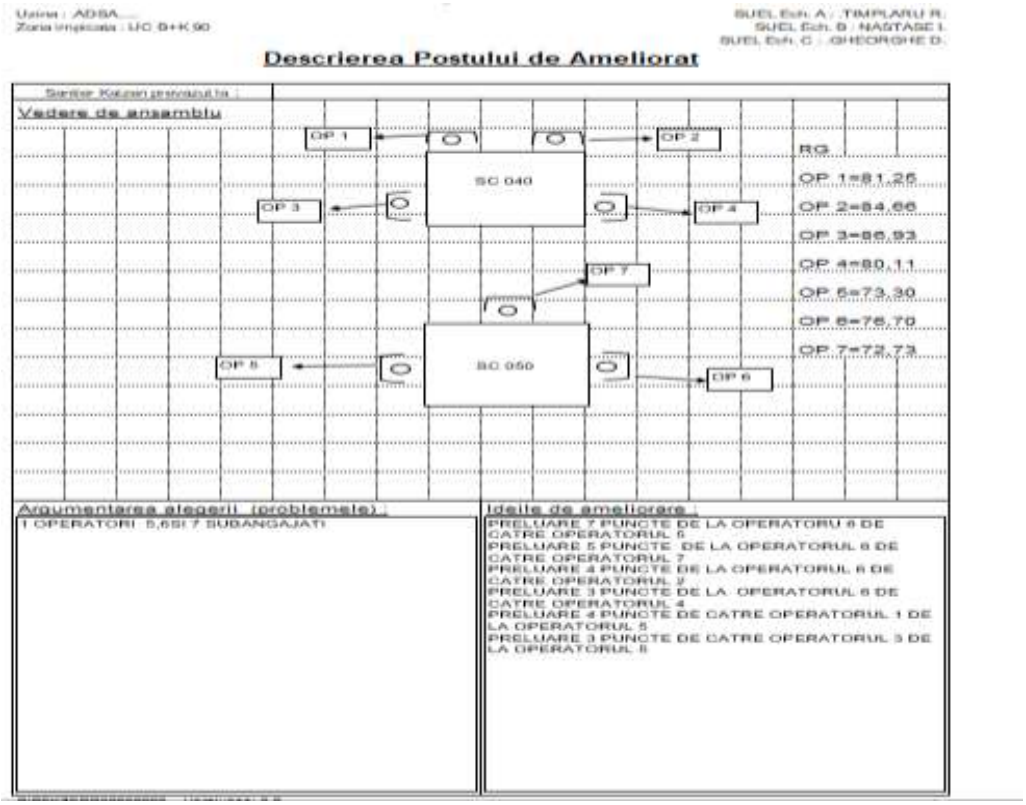


Fig. 12. An example of a workstation description sheet.

Uzina : .....
Zona implicata : .....
Participanti : .....
Data : .....

Tabel de urmarire a masurilor corective

Nr.	Masuri corective	Avansare	Responsabil Termene	Remarci
1	PRELUARE 7 PUNCTE DE LA OPERATORU 6 DE CATRE OPERATORUL 5	REALIZAT	SEF UEL ABC	
2	PRELUARE 5 PUNCTE DE LA OPERATORUL 6 DE CATRE OPERATORUL 7	REALIZAT	SEF UEL ABC	
3	PRELUARE 4 PUNCTE DE LA OPERATORUL 6 DE CATRE OPERATORUL 2	REALIZAT	SEF UEL ABC	
4	PRELUARE 3 PUNCTE DE LA OPERATORUL 6 DE CATRE OPERATORUL 4	REALIZAT	SEF UEL ABC	
5	PRELUARE 4 PUNCTE DE CATRE OPERATORUL 1 DE LA OPERATORUL 5	REALIZAT	SEF UEL ABC	
6	PRELUARE 3 PUNCTE DE CATRE OPERATORUL 3 DE LA OPERATORUL 5	REALIZAT	SEF UEL ABC	
7	MODIFICARE FOS ANGAJAMENT+ANALIAZA	REALIZAT	SEF UEL ABC	
8	MODIFICARE FOP	REALIZAT	PUIU STELA	

Fig. 13. An example of a table for tracking corrective measures.

3.8. Final activity report for "Kaizen in 2 days"

The Kaizen activity report is the form that is completed at the time of completion of the Kaizen site, in which all the details and actions that were taken to achieve the improvement will be specified, the initial situation and the final situation will be presented. This report will be signed by all the people, the managers of the sector where the Kaizen site was built, but also by the people responsible for the security of the perimeter, the quality of the products manufactured in this process and the other functions involved in its development or its possible consequences. This report will also be accompanied by the MPPC (Continuous Product Process Change) sheet, which will also be signed and assumed by the support functions responsible for this change. These sheets will be archived to be able to justify and present the validation of these processes in case of possible audits. In Fig. 14 is an example of a final activity analysis report for "Kaizen in 2 days".

RAPORT DE ACTIVITATE KAIZEN _2J_

Uzina : ADSA	Participanti :
Atelier : B 90	SEF UEL GHEORGHE DAIEL PILOT
Zona :UNITATE CENTR +BF	SEF AT VASILE UNGUREANU MEMBRU
Postul :SC 040+CS050	SEF UEL NASTASE IOANA MEMBRU
Data: din 05/06-03-2011	SEF UEL TAMPLARU ROMEO MEMBRU
Timp de ciclu de productie = 176	CI CIMPOERU DANIEL MEMBRU

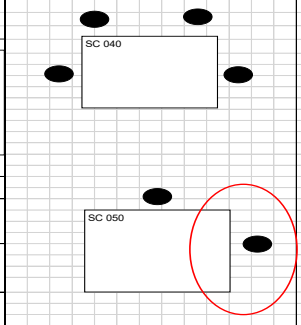
Motivele alegerii (SA/SUEL) :	Ideile de ameliorare (SUEL) :
1 OPERATORUL 5 DIN SC 050 SUBANGAJAT	PRELUARE 7 PUNCTE DE LA OPERATORU 6 DE CATRE OPERATORUL 5 PRELUARE 5 PUNCTE DE LA OPERATORUL 6 DE CATRE OPERATORUL 7 PRELUARE 4 PUNCTE DE LA OPERATORUL 6 DE CATRE OPERATORUL 2 PRELUARE 3 PUNCTE DE LA OPERATORUL 6 DE CATRE OPERATORUL 4 PRELUARE 4 PUNCTE DE CATRE OPERATORUL 1 DE LA OPERATORUL 5 PRELUARE 3 PUNCTE DE CATRE OPERATORUL 3 DE LA OPERATORUL 5
2 OPERATORUL 6 DIN SC050 SUBANGAJAT	
3 OPERATORUL 7 DIN SC050 SUBANGAJAT	

Obiectivul actiunilor			Actiuni de ameliorat		
	Denumire	Obiectiv cifrat	Stadiul	Numar	%
☑	Reducerea timpului de executie, modificarea angajamentului si reducerea numarului de posturi.	1POST	Terminate	8	100%
☐	Reducerea timpului de executie si a depasirii timpului de ciclu de productie (suprimare punct buson).		In curs		
☐	Reducerea timpului de executie si cresterea capacitatii.		Abandonate		
☐	Ameliorarea calitatii.		*TOTAL*	8	100%
☐	Ameliorarea ergonomiei.	.....	Rezultatele asteptate		
☐	Altele (de precizat).		Inainte	Dupa	Eficacitate
Standardizare		Q			%
MODIFICARE FOP -FOS		C			%
		D			%
		RH	7OP	6OP	16%
		FKE			%

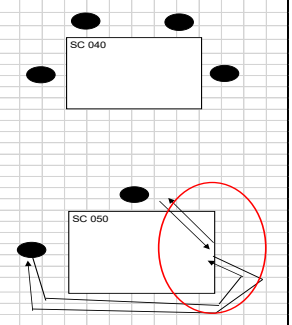
Schema de ameliorare

Analiza si controlul eficacitatii masurilor luate

Înainte



După



Circuit de Validare

	Nume	Data	Semnatura		Nume	Data	Semnatura
SUEL - A	TAMPLARU	05/05-03-2011		S.D.	SILE FULGA	05/05-03-2011	
SUEL - B	NASTASE	05/05-03-2011		S.A.	UNGUREANU	05/05-03-2011	
SUEL - C	GHEORGHE	05/05-03-2011		KZ	GRIGORIU	05/05-03-2011	

Fig. 14. An example of a final activity analysis report for "Kaizen in 2 days".

This final report is nothing more than the confirmation of the improvement brought to the process, or the performance achieved following the development of the Kaizen site, detailing all the actions that were put into practice to obtain these results by the site pilot.

Depending on the degree of complexity of the actions identified within a Kaizen site and the need to put into practice the corrective measures applied in terms of material, financial or intellectual input, we can say that these sites can be, from the point of view of financial input, divided into two major types of Kaizen sites,

namely Kaizen sites made with investments and Kaizen sites made without investments.

Conclusions

In all fields and activities around the world, performance and competitiveness is aimed at by everyone, because if you are performing and competitive in what you do, the activity carried out will also be profitable.

The principles of the Kaizen philosophy, even if they are not known by name, we identify and apply them, both consciously and unconsciously, in all the fields and activities carried out by us.

In companies, on different production lines, this approach, even if it is not a standardized one and followed according to the established planning, is carried out day by day, on a small scale, even without realizing it. It can appear in the simple activities of setting up a workstation according to a reference state or in any other form.

This approach plays a key role in the smooth development of the activity and the fulfillment of the performance objectives of any organization.

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