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TRANSFER FROM TRADITIONAL KANBAN TO KANBAN 4.0 IN SMART FACTORY

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Abstract: Type Quality 4.0 aligns with the new trend in Industry 4.0, successfully moving through quality management to the digital environment. Companies that invest in Quality 4.0 will achieve significant improvements in the value chain through operational efficiency and services, thus maintaining customer satisfaction but at the same time and implementing a culture of company quality. Quality 4.0 refers not only to technology, but also to people who use technology in technological processes. Applying the traditional methods Kanban, Gemba and the 7 W's "without" some weak links of the technological processes were found. We can consider that this is how the first steps of the transfer and the awareness of the transfer to the Kanban 4.0 method were performed. The article presents the solutions taken by a factory to improve quality management. By applying a questionnaire to the three work teams of a technological process, it was possible to identify weaknesses in different stages of the process. The questionnaire was structured so that the following indicators were taken into account: visibility of the working method, stock of raw materials, workflow, continuous improvement through the feedback mechanism, teamwork, measures applied, quality and well-defined processes in the verification and maintaining the quality of production processes. By applying the questionnaire it was possible to identify the principles of the Kanban method: visibility, accessibility and standardization applying the Kanban method. The article presents the solutions taken by the factory to improve quality management and harmonize the technological process with the new concept of intelligent manufacturing. Quality 4.0 offers also a variety of tools and techniques that can be implemented to automate compliance activities to the digital factory.

Keywords*:* quality management, culture of quality, Industry 4.0, Quality 4.0, Kanban 4.0

1 INTRODUCTION

Industry digitization and Industry 4.0 are not just about technology. The business environment must prepare for radical changes caused by a number of factors: speed, volume and unpredictability of production, as well as further fragmentation and reorientation of value chains, new relationships between research institutes, higher education and the private sector, new business models, new connections between large and small enterprises, new ways of cooperation between all levels of business (design, production, sales, logistics,

maintenance), the need for updated and new skills, along with new ways of working, as well as closer links between the business environment and the user. Traditional industries in particular face the challenges of these completely new concepts. Many organizations want to promote and generate a culture of quality but at the same time they need to developt a strategic plan.

By connecting data, analysis and processes and thus improving visibility, connectivity, collaboration and perspectives, Quality 4.0 makes more real a true culture of quality throughout the organization (https://www.juran.com/blog/quality-4-0-the-future-of-quality/).

A digital factory includes technologies such as the Internet of Things, the analysis of large volumes of data, real-time end-to-end planning and control, autonomous systems, cyber security and the concept of "digital twins". It is a key strategy used by many manufacturers for more sustainable production. We have embraced this digital world, taking on the role of rethinking innovation and facilitating the digital transformation from the old factory to the smart factory concept.

Innovative solutions based on intelligent energy using machine learning and artificial intelligence allow more knowledge and exploitable information from assets. The integration of the concept of digital factory in the operations of virtual factories can be achieved by applying the concept of continuous improvement in all stages of the technological production process.

As Masaaki Imai (1997) points out, restructuring or reinventing the company can be destructive, costly, and often dysfunctional. By applying Kaizen to Gemba, significant, low-cost improvements are made to the core business processes - production and services, and major leaps can be made in customer satisfaction, quality, productivity and profitability.

The lean manufacture technique today has become ”lean thinking” as an important part for the production sector.

The industry has inspired many researchers to investigate and propose its adoption James et al. (2003), Kwofie and Pasquire (2020). Rosen et al. (2020), Kolberg and Zuhlike (2015), Mayr et al. (2018) established the impact and link between Industry 4.0 and lean showing that lean principles are in direct connection with Industry 4.0 technologies.

Opportunities and global competitiveness for companies were identified by Schwab (2016), but the answer to the new challenges brought by Industry 4.0 and quality was found by Micklewright (2019) and the impact Industry 4.0 and lean principles by El Manti et al.(2018), Rosen et al. (2002). The tools used for lean manufacturing are 5S, Kanban, Kaizen or Six Sigma.

2 KANBAN CONCEPTUAL BACKGROUND

Kanban is a concept initiated by Japanese managers, which means a peculiarity of continuous change, day by day, in the sense of improving the activity of organizations. Unlike the Western conception, which involves total change, at long intervals, with the use of a large volume of resources, Kanban therefore seeks a gradual improvement in the monitoring of stocks and raw materials. The Japanese have shown that although the improvements achieved by applying Kanban are small at one time, evaluated over long periods of time, equivalent to those in which radical changes in Western organizations take place, the results are at least equal. In addition, the improvement obtained by applying Kanban is achieved with a minimum of expenses and is ensured by the participation of the entire staff of the organization. The evolution of technology and the new wave of Industry 4.0 has led to a new factory model, tomorrow, smart factory. Technology support 4 also introduced the new e-kanban (https://www.kanbanbox.com/fr/ ekanban-rfid-industrie40).

The fourth industrial revolution is based on cyber systems. This for a factory means that all objects in a manufacturing environment are interconnected. Kanban 4.0 is the transfer from traditional kanban with cards components with new digital transformation technology as smart kanban and e-kanban as a new technology of traditional kanban.

The new Industry 4.0 on the other hand has emerged as an industry of the future that is based on cyber systems. Houti et al.(2017) they highlight the need for the transfer to an electronic Kanban production system (E-Kanban), which is in fact the logical continuation of the classic traditional Kanban card system.

The evolution of the kanban system making a parallel with the industrial revolutions presents the evolution of kanban within industry 4.0 (Figure 1).

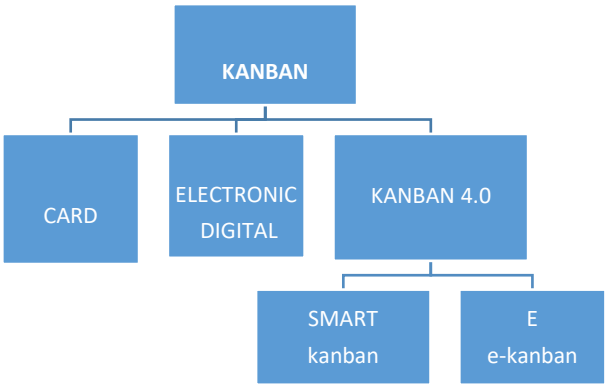

Figure 1. Kanban stages evolution

The transfer to e-kanban was due to the fact that kanban signal uses the new technologies given by the industrial revolutions, replacing a weak traditional kanban tool for the production system that controls the flow of material between workstations by using kanban signal (El Abaddi et al. 2018 and Houti et al. 2017).

Smart kanban is an online portal that allows the entry of basic data and allows the printing of production and transport cards with a single click. This saves a lot of time, minimizes costs and takes into account the needs of customers (https://www.news-in-industry.com/smart-kanban-kanban-made-easy-328359.html).

Smart kanban offers free several Kanban card templates or the team of manufacturers can create each type of company-specific Kanban card scheme, based on customer needs.

The kanban system makes the difference because an e-kanban solution helps companies reduce stocks by up to 40%. The system is based on visual control of production, facilitating communication and ensuring the self-regulation of workstations for a minimum level of stocks (http://www.capital.ro/sistemul-kanban.html).

E-Kanban, is the logical continuation of the classic traditional Kanban system with cards. The advantages of e-kanban over traditional card kanban would be: greater transparency, traceability of movements in the system and a greater number of materials.

Some manufacturers as noted by El Manti et al.(2018) have already come up with proposals for solutions respectively: e-kanban 4.0, which is a combination of electronic kanban, the use of electronic ink to replace the label containing container information. It is observed that the kanban system will be changed and transformed so that all components adapt to the new environment.

The kanban system must harmonize with the new type of industrial revolution and transform into the new type of kanban 4.0 or smart kanban. Zhong et al.(2017) and Shuyou et al.(2017) admitted that next generation of industry—Industry 4.0—holds the promise of increased flexibility in manufacturing, along with mass customization, better quality, and improved productivity.

Houti et al. (2017) and El Abbadi et al. (2018) mention also that to get around the traditional kanban limits, the most optimal solution is the use of the electronic kanban system, based on a digital signal, which offers many advantages over the kanban card system or digital kanban boards (Modrich and Cousins , 2017).

Houti et al. (2017) and El Abbadi et al.(2018) also consider that all objects in a manufacturing environment are interconnected and in that way the kanban system can be transformed to the kanban 4.0 or smart kanban.

Inventory management through Kanban is focused on improving each process in the product data sheet, the main goal being to eliminate losses.

Soulard (2001) and Taichi (2005) and Shingo (2018) present the kanban method as the method of process improvement and production efficiency.

Kanban activities ensure a maximization of the value of the product corresponding to the requirements of the beneficiary, a qualitative differentiation of it, which makes it more attractive, and the customer being more interested in buying it. In the activities of economic organizations, losses can be generated by the following causes:

- over production, occurs when the volume of manufactured production exceeds market demand;
- the requirements of the Just-in-time method are not observed, the stocks of parts brought to the workplaces are not optimized;
- internal transports are not optimized, generating unnecessary movements in the manufacturing flow.

We must remember that Ohno (1989) and later Brunner (2011) specified that the Kanban working system is the basis of the lean production system and all the methods used by it.

The advantages that implementation brings concept:

- implementation costs are low, as we make better use of existing resources and do not involve large investments in technology improvement;
- staff training costs are lower than in other methods;
- we have achieved remarkable results in the field of labor productivity, cost reduction and increased competitiveness.

In Romania there are numerous consulting companies in the field, including a Kaizen institute, with important achievements in the implemen-tation of Kanban.

The benefits of Kanban are:

https://wwwthinkinglean/kanban1%28benifits%29)

Reduced inventory, as components are not delivered until they need to greatly reduce the need for large stock and large storage space.

Waste and scrap reduction

With Kanban, components are only manufactured when needed, so the production of extra components is eliminated. As there is no extra production, cutting waste and scrap are reduced.

It brings flexibility in production

If there is a sudden drop in demand through Kanban, it is ensured that the manufacturer does not keep products in stock.

In this way production flexibility is achieved to respond quickly to new demands and changes, also it can produce other different parts of that product until then, depending on the demand. Kanban also brings flexibility in the way the production line is used. Production lines are not fixed on a single product they can be produced with minor changes and other landmarks. The only limit is given by the type of machine, the equipment used and the skill of the employees.

Increasing production

The Kanban flow (labels) stops if a production problem occurs. By stopping the flow of Kanban it is immediately noticed that a problem has arisen and allows it to be solved as soon as possible. Kanban reduces waiting time by making stocks more accessible and breaking down administrative barriers.

Kanban reduces the total cost by:

1. Prevents the additional production of products;
2. Development of flexible workstations;
3. Reduction of waste and scrap;
4. Reduction of waiting time and logistics costs;
5. Reduction of the stock level and additional costs;
6. Saving resources by organizing production;
7. Reduction of inventory costs.

Limits of the Kanban System:

a) Ideal for large series and mass productions with a small variety of parts;
b) Vulnerable to fluctuations in demand;
c) Vulnerable to changes in production processes and possible failures of equipment;
d) Ineffective in case of irregular orders or when solving special, unforeseen orders;
e) Vulnerable to the lack of stocks of raw materials and to the change of their delivery time.

Kulkarni (2017) argues that Kanban is often seen as a central element of "Lean" manufacturing and is probably the most widely used system of applications in industry and other economic sectors. Kanban can also be associated with Just-In-Time (JIT).

However, Kanban is not yet a name for Just-In-Time it is a component part of the Just-In-Time system, Kaizen and the 5S's.

A requirement for Kanban to work is for people to work in teams:

1. Familiarization with the Kanban concept and the objectives it pursues;
2. Selecting Kanban components that are suitable for the Kanban Company may be optimal for some products and not for others. In some cases traditional Kanban will work wonders, and in other cases automating the Kanban system is the ideal option;
3. Kanban system planning involves more than manufacturing. Other functions such as purchasing, sourcing, shipping/receiving, quality control, transportation, design will also be involved in Kanban system planning;
4. Establishing the objective of the Kanban system;
5. It is based on the planning done and establishes a program to achieve the objectives, establishing the level of the manufacturing and inventory system before implementing the Kanban system;
6. Start implementing the Kanban system.

The most common way to implement the Kanban method is to introduce a large number of containers, pallets and bags known as kanban. Then the number of containers is reduced until a balance between demand and production is reached. When we notice that the production is delayed due to the insufficient number of containers in this case it is necessary to reintroduce another container to bring the system back into balance.

In essence, the application of the Kanban method requires compliance with the following rules in accordance with the literature Just-In-Time Manufacturing:

- the downstream workstation (place) signals to the upstream workstation (from which it must receive parts) that it has started to processing the first part of the part of the waiting parts container;
- upon receipt of the signal and the sheet mentioning the parts in the required quantities, the upstream workstation executes the required parts and quantities;
- the work station, located downstream, is replenished with a new container at the right time, in order to ensure the continuity of work;
- upstream workstations must provide only good quality parts or products;
- stabilization and appropriate adaptation of production cycles.

3 CASE STUDY

Taking in consideration the study of Stadnicka et al.(2020) who highlighted the problems of the flow of materials and information in a complex product manufacturing process, the paper presents methods and tools that can be applied in production systems. In this paper a case study was conducted using an innovative method of production optimization, namely the kanban method also in the context of small and medium-sized enterprises (SMEs) the benefits of the method are: low costs, low tools and high flexibility.

This paper aims to become an example of efficiency through the use of the kanban method, and to systematically present the most viable proposals and actions aimed at increasing competitiveness and market image.

As the products are more complex, the manufacturing systems and the management control processes must be adapted, the paper presents how to implement the information obtained by applying the kanban method and the decisions taken to trabsfer to the new model of industry. These decisions attract new levels of automation that are required by Industry 4.0 and the use of digital systems in SMEs (https://www.eaton.com/usen-s/company/digital-innovation/industry-4-0 /industry-4-0- and-the- drive-for- long-term-growth.html).

The case study was carried out within the company S.C. EATON, a company that deals with the production of electrical fuses and more. The company stands out on the specialized market worldwide, through the quality of the products offered, the policy and the code of ethics promoted, but also through sustainable and successful partnerships.

S.C. EATON operates in the field of electrical systems and equipment, in the distribution and control of energy, but also other sectors such as automotive, fluid power, hydraulic and truck with over 70,000 employees worldwide. From the position of global leader in this sector, S.C. EATON acquired the Moeller group - the manufacturer of electrical equipment and automation in the spring of 2010. The entry of Moeller Group into the American concern S.C. EATON was also felt at the level of Moeller Electro-Production from Sîrbi, Fărcaşa commune, Maramures County.

Moeller is now part of Eaton a new colossus in electrical engineering is being set up. The quality of the products and their high technical level has been, over time, the attributes for which Moeller was famous throughout the world. These attributes have been taken over and will be further developed by Eaton. Eaton offers modern solutions for energy distribution, control and monitoring of industrial processes using protection and switching equipment, control systems, frequency converters, PLCs, electrical panels. Eaton is the largest company in Maramureş and the second employer in the county after the furniture manufacturer Aramis Invest owned by Romanian entrepreneurs and despite the economic crisis, it continued its development strategy, inaugurating a new factory in Busag near Baia Mare city. Essential for using Kanban is the constant improvement of the activity and the initiative of self-improvement of the team from S.C. EATON.

The purpose of the Kaban method is to master and adapt production, permanently, to consumer demand, at the cost of a radical transformation in the principles of organization and operation that govern industrial enterprises

https://www.eaton.com/us/en-us/company/digital-innovation/industry-4-0.html).

In this transformation, a key role is played by logistics, ie the management of flows within objectives of enterprises:

1. adjusting demand fluctuations or production volume at a workstation;

2. minimizing the current stock, with the limit objective of having a zero stock;

3. decentralization of the production workshop, management, the responsibility for the management of production and stocks being entrusted to the team at this level.

The manufacturing process at the welding section was subjected to a control, in order to identify the factors that create the disturbance of the entire process and to identify a solution.

Fizza Kamal (2020) in his study presents the opportunities and challenges od using survey, so in that case study the Gemba visualization technique for the Kanban method was applied using a short structured survey of several questions designed to identify staff opinions using the Kanban method in terms of the knowledge of the staff involved and to determine the needs or what could be improved. The adaptation of the results of the Kanban method based on the data obtained according to Klipp (2012) and Brodzinski (2012) can be found in the maturity chart, which makes it possible to identify the same characteristics for the Kanban maturity chart, for a specific section on product organization or manufacturing (Joziç et al, 2015).

a. Workflow view - How well does the team consistently use standard work tools to make the workflow transparent? (http: // germanbraunblog 2013);

b. WIP Limit - Does the team set WIP limits and use them as a flow management tool?

c. Flow Management - How well does the team constantly observe the workflow, using appropriate measures as guides in a continuous process of waste reduction, through a constant improvement of the way of working?

d. Well-defined tasks - Has the team set clear and explicit tasks and are these policies reviewed as necessary?

i. Collaborative Improvement - How well do usage models test ideas in order to introduce process improvements? (Boca et al. 2015);

f. Feedback Loops - How well do you give and receive feedback on quality and process checks?

j. Process quality - indicators, knowledge and standards, 5S's and Gemba (Boca, 2015).

The graphic radar and maturity of the Kanban implementation was applied to three teams working on the same welding section.

The diagram will be used as a tool to visualize how well a team is performing the process and what are the weaknesses in the Kanban process.

4 RESEARCH METHODOLOGY

Before applying the questionnaire, all the indicators were clearly presented in the production halls, so that each employee is up to date with the production data and the strategic objectives of the sector in which he carries out his activity. Thus we detailed to the employees the situation of the five important indicators: occupational safety, quality, delivery on time, stocks and productivity.

For productivity and production performance we took into account the opinion of Dimitrescu et al. (2018) identifying the most important production indicators:

1. FTQ: quality at the first check;

2. OEE: availability of machines=total efficiency of equipment; it is calculated as follows: availability * performance * quality * 100;

3. Processing Time: Internal processing;

4. Quantity Produced: passed in statistic by each foreman;

5. Receipt: irrecoverable.

1. FTQ: quality at the first check

The procedure involves collecting all these indicators on a weekly (but also daily) level to monitor the evolution of a working cell in reaching/ exceeding or not achieving the target assigned to each. The target is calculated on each cell. The FTQ target of a cell is calculated by analyzing the amperages that are made on that center, a history for at least 3 months but also the potential to reach the target are presented in Figure 2:

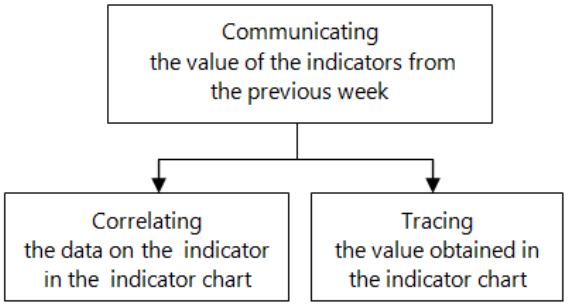

Figure 2. Production indicators
Source: By authors

2. OEE: availability of machines = total efficiency of equipment is calculated as follows:

Availability * Performance * Quality * 100

The OEE is a product of the performance (meeting the target quantity) and the FTQ of that center (Figure 3). The quantity produced is calculated according to the capacity of the checking and printing machine according to their tact.

Figure 3. OEE
Source: http//www.eaton-electric.ro/ro

3. Processing Time: Internal processing

The processing time is unique and preset to 48 hours. The scrap is calculated weekly, is unique in turn, and has a barrier of 0.5%. When the indicators are met/ exceeded, the respective cell visually signals this aspect by passing the indicator in production (above the assembly lines) on the green color but also drawing in the graph of the respective indicator a green line (Figure 4).

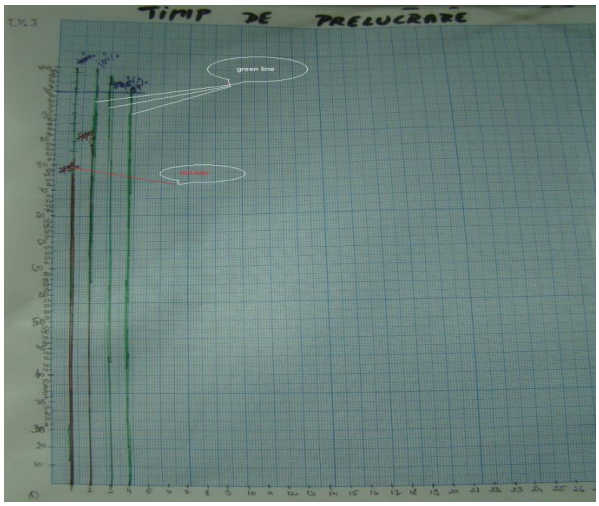

Figure 4. TPI collection
Source: By authors

Table 1. Analysis A3 = Report A3

Background information	**Counter measures**
Identifying the problem	
✓ What of the strategy / objectives creates the need to act on this issue now? ✓ What problems or issues are taken into account ✓ Summarize the business situation - Business Case that makes this a priority ✓ With will be selected the indicators measured at the strategic objectives of solving the problem	✓What unresolved issues and obstacles need to be overcome? ✓What is everyone's priority ✓Who is responsible for the elements of action? ✓When is the end date for each action item
The current situation	**Confirmation of effects**
What are the facts. Data that supports the need to act?	Stage tracking • start indicator of the initial stage • up-to-date progress of the current state • target objectives-the objective of the future stage
Objective	**Corrective actions**
Root Causes Analysis	

If the indicator target is not met, it is signaled in production in red and a red line is drawn in the graph. The lines drawn in the graph also show the percentage obtained by the respective cell for the previous week. If a certain indicator is below the target, the causative factors are sought in order to be eliminated and to return to the fulfillment of the plan.

4. Analysis A3/Report A3

If it is more difficult to establish the cause, an Analysis A3 or Report A3 is made (Table 1), following which solutions are obtained that help eliminate problems, but also confirm the effects of prevention and elimination.

5. The rule of the 7 "without"

Kanban system production depends on the supplier's request, so it is necessary to check the whole process:

- calculation of average consumption for the last three months for all types of materials in a given group A (only for domestic production);
- to establish the optimal batch size and how many parts can be made during an 8-hour shift was necessary to calculate;
- calculation of the average consumption for one day for the six materials with the highest registered consumption (current status of 12 codes -70%) from the production line.

According to kanban principles, each unit must produce exactly the amount needed at any given time. If Michaels (2018) has identify seven ways to improve operations given the importance of the kanban system, it is often presented as essential in implementing the rule of the seven "without":

1. without deficiencies;
2. without unnecessary delays;
3. without unnecessary deliveries;
4. without unnecessary queues;
5. without periods of inactivity;

6. without unnecessary control processes or operations;
7. without unnecessary movements.

4.1 *Questionnaires structure*

Kanban is considered a central element of Lean manufacturing and is probably the most widely used application system.

The Kanban method were used along a continuous system of component supply of workstations to identify if workers have what they need, where they need it and when they need it. During our Gemba visit, it was easy to identify the four simple principles of Kanban:

1. visibility;
2. accessibility;
3. standardization;
4. quality.

It was checked whether all three teams in our case established a standard type of cards/ labels for all materials included in Kanban (specific color). They modified the labels in several colors; thus the probability of entanglement was reduced. It was also checked whether the order and how the Kanban cards will be placed on the panel was established.

A questionnaire was applied to three teams from a technological process line, and was contain nine items for each specific Kanban points in Gemba highlight. Workers were able to identify the situation they face on a daily basis at work or the deficiencies encountered and which need improvement. The questionnaire was applyed in same day of February 2021 for each team member and he had the opportunity to select the answer option on a Likert scale. The scale was from 1 to 5 where 1 = I don't know, 3 = We will do this and 5= I need. After the data collection it was possible to identify the week point and to establish some measures to improve the technological process.

The respondents have to answer to the following items:

I1. How is the visualization of the working mode;

I2. Used of raw material stock (WIP);

I3. Management of workflow (low);

I4. Continuous improvement through the feedback mechanism;

I5. Micro medium and teamwork collaboration;

I6. Explicite polices, measures to be improved;

I7. Quality;

I8. Effects of results;

I9. Well-defined processes (feedback mechanism).

5 RESULTS

The method was created based on the model of how organization observed and need changes (McMillan, 2004) and teamwork behavior on technological process (Anderson and Bartholdi, 2000). The answers of the respondents are presented for team 1 in Figure 5. For team 1 based on the data obtained we notice that the highest score was obtained for thestock of raw material and the lowest score by visualization.

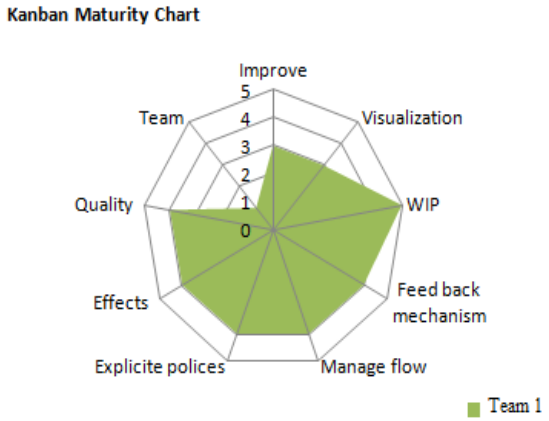

Figure 5. Kanban and Team 1 needs

In our for team 2 there is a need to improve the Kanban method and to create some procedures to make the information from different stages of the technological process more visible (Figure 6).

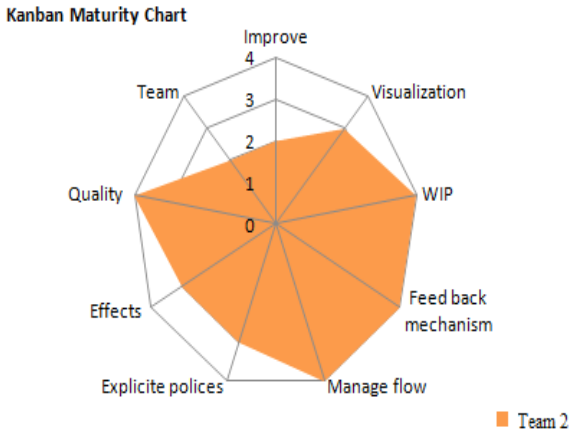

Figure 6. Kanban and Team 2 needs

The results also present the maximum score for quality, manage flow, feedback mechanism and raw material stock. For team 3 the maximum score obtained was for quality and for visualization the lowest score was obtained togheter with WIP and the feedback mechanism (Figure 7). Results for explicit polices, effects and visualization reflect a need to improve the Kanban method and create some procedures to make the information from different stages of the technological process more visible.

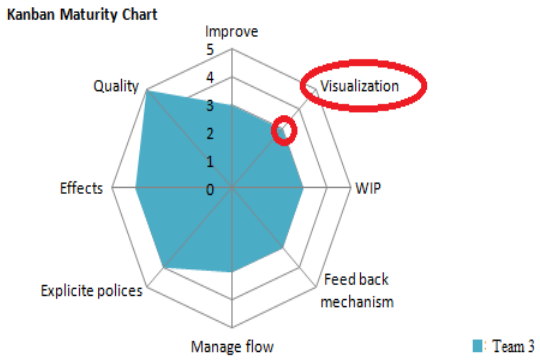

Figure 7. Kanban and Team 3 needs

The chart provides information about how the implementation of Kanban is perceived and which sensitive elements need more attention and can be improved. The area and borders obtained in the final maturity chart are presented in Figure 8.

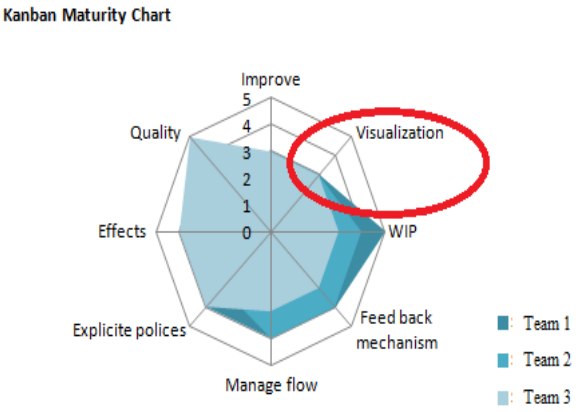

Figure 8. Maturity chart for Kanban method

The scores obtained in the final maturity chart provide information on how the implementation of the Kanban method is perceived and which sensitive elements that need more attention and can be improved. In our case study the visualization was mentioned with a score with low values. Considering that the visualization received the lowest score from the three teams, we proceeded to identify the factors that led to this score.

The next step in the research was to identify the factors that contributed to this score, and check on each segment of the technological process required. Ahmad et al (2013) revealed the strengths of the Kanban method in software development.

But at the same time they stressed the need for more rigorous research on the basic principles of the Kanban method namely: visualization of workflow, limitation of work in progress, measurement and management of flow and its relationship with organizational culture, team leadership, self-management teams, team learning mechanisms and team motivation.

Taking in consideration the weak point visualiation it was possible to identify solutions which are presented below.

Box storage mode on the production shelf:

From the place of production it was possible to identify for the visual element the two types of storage on the production shelf wrong Figure 9 and incorrect Figure 10.

Figure 9. Wrong "components" in cardboard box shelf

Meanwhile, workers know exactly how to put the box shelf on the tape, to protect also the product quality (Figure 10).

Figure 10. Shelf "components" in correct cardboard box shelf

We can see that the solution was to mark the box shelf with a label with all the details regarding the product using a barcode. From the production shelf we can present the box storage mode on the production shelf (Figure 11) and observed the red line which delimits the place established for storing each material a stage that is part of Kanban.

Figure 11. Production shelf

Each box is placed on the shelf with the label down, only the person who takes the box off the shelf will see the label on the box.

Another solution more efective for storage on the production shelf was the Kanban ''cafe components" in plastic box packaging like in Figure 12.

After solving the visual problems on the production flow, it was considered necessary the sound signaling to prevent, as in the Poka-Yoke technique, any skidding, delays or interruptions. Poka-yoke is another tool that helps operators avoid mistakes, therefore, it favors detection and elimination of abnormal conditions to prevent defective products (Brunner, 2011).

Figure 12. Cafe "components" cardboard box

The light signaling facilitates the reaction in time to the production status regarding Kanban. Kanban is about evolution, not revolution and help with red signals Figure 13 the delays and mistakes and with green signals just in time events like in Figure 14.

Figure 13. Visual Red signal

Figure 14. Visual Green signal

6 CONCLUSION

The implementation of the Just-in-time method in the economic organizations could bring:

- immediate gains by eliminating waste and losses, by increasing labor productivity by 20-30%;
- reduction of operating costs by 15-20%, reduction of used areas, reduction of equipment requirements.

The great shortcoming of the Just in Time approach is the fact that in exceptional situations where there is a high demand on the market, at some point in time, this type of organization can not meet it. However, even if production processes are extremely flexible to cope with variations in demand, it is not necessary for people to have developed this quality of being flexible and innovative, as is mandatory in total quality management.

Just in Time remains an extremely current approach in modern management, but it must be borne in mind that this method creates and is based on a strong organizational culture:

- Quality makes the business more competitive;
- Quality brings profit by satisfying customer demands;
- Over time, in a free market, quality commands a higher price for products and services;
- When customers have options, they reward quality and punish "lazy" organizations, both in the marketplace and in the stock market.

The benefits obtained are interdependent and contribute to the decrease of the response time to orders, due to a shorter and more efficient development cycle. The benefits relate to:

• Increasing customer satisfaction and market share;
- Improving product quality;
- Improving the control of essential processes;
- Increasing employee satisfaction;
- Increasing the number of loyal customers;
- Reduction of customer rejections and complaints;
- Efficient use of personnel, machines and materials, resulting in higher productivity;
- Elimination of production malfunctions and tense working atmosphere;
- Achieving quality awareness and greater job satisfaction among employees, thus creating a cult of quality at the company level;
- Customer trust;
- Improving the image / delivery on time and the credibility of the company.

The benefits are difficult to predict in value

Most are subjective in nature, interpretable, and generally refer to the quality of the company's products and relationships with employees and customers. Also, other benefits, such as increased customer satisfaction, increased flexibility in the use of resources and increased employee satisfaction cannot be measured financially. The financial advantages are given by the increase of the main economic-financial indicators (turnover, profit) as a result of the increase of the efficiency of the use of resources. Experience has shown that standardization has beneficial effects on the results and quality of the products generated.

The conclusions generated concern the quality

Quality no longer just means meeting customer requirements. It has become a competitive pursuit for added value, for the as yet inexperienced customer requirements. The company needs to set great goals and then focus on achieving them. The purpose of the quality policy is to take into account, at all stages of the quality spiral, the interests and requirements of the beneficiary (of the customer) regarding the quality of products and services, taking into account the human, material and financial resources of the enterprise and society. These are also the goals of Eaton-a company with a tradition in the electrical safety industry in the world. In recent years, the company has formulated a policy and a quality system in line with current requirements.

Motions

The positive results are visible, as the company has managed to form a good reputation and image, quality control is carried out according to regulated procedures, staff is trained in internal quality policies.

All this had as consequences:

a. Reducing the percentages of non-compliant products;

b. Maintaining the safety of products at work at all times, in accordance with international standards;

c. Better relationships with customers, who are satisfied with the superior quality of products and delivery of what they asked for, when they asked for it (OTD);

d. The advantages of these measures are more or less quantifiable and are observed in a different time horizon from the immediate results, related to the increase of sales, of the profit, to the observable ones in the long term, customers, increasing the prestige and image of the company, changing the concept of quality.

Increasing customer confidence in the organization and its products.

The client's perception of an organization as a well-organized structure that shows maximum seriousness is essential in drawing up contracts. The more contracts the company draws up and honors, the more its benefits can increase.

Improving activities and streamlining them.

This is an important gain for the organization, because only well-described activities can be monitored, evaluated, improved and presented to new employees in training activities. Increasing the responsibility of the staff engaged in carrying out the activities based on clear responsibilities described in written procedures:

- Rapid and systematic adaptation to changes in market conditions;
- Avoiding errors instead of correcting them;
- Save time and money;
- Integration of modern risk analysis procedures and the concept of prevention;
- Greater product safety and lower product warranty risks;
- Significantly improve communication and increase trust between customers, suppliers and supervisors.

All these measures can only be beneficial for the company's activity, as it ensures the increase of overall performance and, at the same time, contributes to the achievement of a modern and efficient conception of quality, aligned to international norms and which aims to best meet customer requirements era in which quality is paramount.

Kanban and Smart factory

Based on the weaknesses noticed by the staff during the technological process, the company has adopted the road to the new type of smart factory and will adapt to the digital evolution. Kanban 4.0 is driven by the application of an electronic kanban material flow management system, using tablets, computers, digital labels, a fast digital platform with cloud access.

Last but not least, Kanban 4.0 is based on new digital technologies and web software through the processes of order digitization and supply management within the technological processes that will lead to the improvement of organizational processes, products and services. However, this process of change requires first a new cultural model and then one of harmonization and transformation by connecting to technology. Smart factory will transform the production system into a cyber-physical production system adapted to the new Industry 4.0 model here, including the kanban system.

As a final conclusion the study shows that unlike the Western conception, which involves total change, at long intervals, with the use of a large volume of resources, Kanban therefore seeks a gradual improvement in the monitoring of stocks and raw materials. The solutions presented in the study showed that although the improvements obtained by applying the traditional Kanban method are small at one time, by evaluation over long periods of time, they are equivalent to those in which radical changes take place in Western organizations, the results are at

least equal. In addition, the improvement obtained by applying Kanban is achieved with a minimum of expenses and is ensured by the participation of the entire staff of the organization. The study showed that Kanban aims to maintain a continuous flow of material through maintaining a predefined stock level to ensure uninterrupted supply of material. By simulation methods or in real time virtual new kanban 4.0 loops can be planned with more foresight and perfectly integrated into existing production environment. Simulation ensures identification of ideal kanban parameters, such as batch size, stock or delivery frequency. Moreover, external changes can be included while the system refreshes the independent (Kolberg and Zühlke, 2015). The study also confirmed the theory of Mayr et. (2018) by the Poka-yoke method found and the generation of forced, visual and sound sequences by reviewing the process during execution and stopping it in case of errors.

6.1 Limitation of the study

The research was conducted at EATON S.A., a company that has implemented the quality system and already uses the traditional kanban method. The method shows a simple way to apply digital technology as a solution. This paper aims to become an example of efficiency by using the kanban method and to systematically present the most viable proposals and actions aimed at increasing the competitiveness and image of the market.

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