Increasing the Productivity of Liquid Filling Line for EVYAP

Sabancı Üniversitesi FACULTY OF ENGINEERING AND NATURAL SCIENCES

EVYAP

Student(s)

Reha Gören
Batuhan Akpınar
Öykü Tınkış
Yusuf Sertbaş
Gizem Çuvalcı

Faculty Member(s)

Esra Koca

Company Advisor(s)

Sedat Delibalta

ABSTRACT

This Graduation Project is about the liquid filling line of Evyap's production department. The aim of this Project is to increase productivity of Liquid Filling Line for EVYAP

EVYAP performs an important part of the soap and personal care product exports of Turkey and transports its name to more than 100 countries. Evyap has been manufacturing in 3 different countries compatible with European standards and besides it has built the world's biggest Oleochemistry Plant in Malaysia. Duru, Arko Men, Arko Nem, Evy Baby, Fax and Activex are important brands embodied by EVYAP.

The main goal for this Project is to increase Overall Equipment Efficiency from 60% to 70% with analyzing failure rates and other methods. OEE is the is the gold standard for measuring manufacturing productivity and OEE takes into account the various sub components of the manufacturing process – Availability, Performance and Quality.

The other goal is decrease the time during mold changing process. During mold changing process many time loss has been observed. The reasons behind that and how to have a better mold changing process has been analyzed

Objectives/Results

The main aim of our project is increasing the OEE rate of the liquid filling line from 60% to at least 70%.

•Detecting the unknown failures which had not been described to the system before

Result of our objective: "Kapak Elevator" creates the biggest ratio of the unknown failures. The causes of unknown failures become visible for EVYAP production department. The aim of our objective is increasing the OEE rate by removing the uncertainity and increasing the productivity.

•Focusing on the major cause of unknown failures

Result of our objective: Most of the Kapak Elevator failures caused by the low quality of the plastic material which causes Kapak to damage quickly and fall.

•Reducing the time spent for the mold changing process

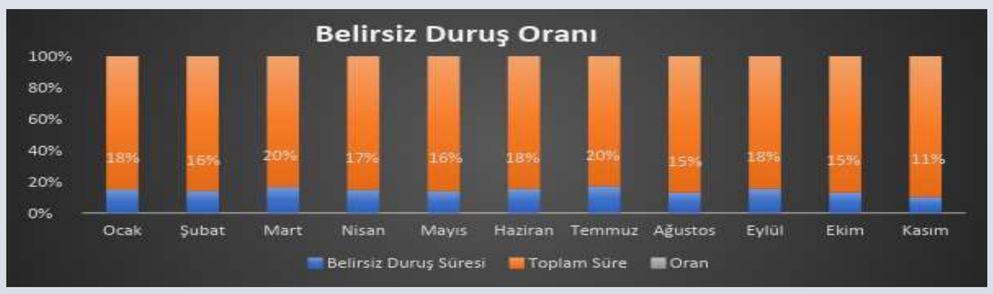
Result of our objective: It can be argued that most of the idle time during the mold changing caused by the lack of qualified operators who are able to do every type of the work. Mold changing time can be decreased by qualified workers who have enough technical knowledge about his tasks and the machines and can shift their capacity from low utilization station to high utilization station. Without qualified, trained operators, the operations cannot start simultaneously at every work station and unqualified operators have to wait for qualified operator to solve the problem or make some technical adjustment that unqualified operators cannot do.

•Buffer

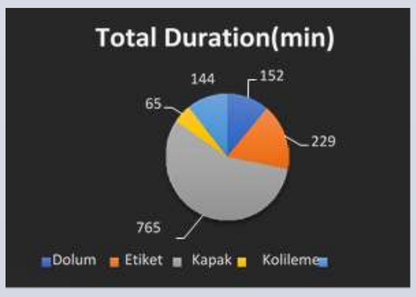
Result of our objective: With a buffer application we have obtained that stoppage times may decrease. A problem at any operation may cause a stoppage for all operations and for the line. However with a buffer this problem can be solved without stopping the production

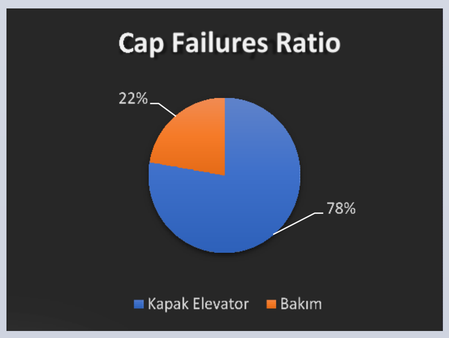
Analysis of Unknown Failures

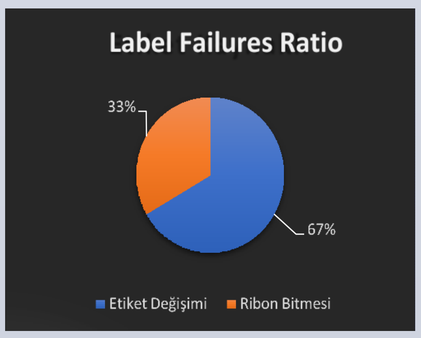
•Although there is a system to describe the type of the failures, some of failures cannot be recorded to the system by operators. These types of failures are described as unknown failures.
•The different workstations at each line were examined and the problems which cause failures at each station were detected. The type and the duration of unknown failures which had not been described to the system before, were recorded by our group member.
•According to our data analysis, the percentage of unknown failure varies from month to month. It can be seen from table below that unknown failures form around 17% percent of the total failures. This analysis was made by removing the failures caused by vacation.



•According to the analysis, we have found that the main reason of the unknown failures is caused by Kapak, Etiket, Dolum, Posimat, Kolileme in a decreasing causation order. It can be clearly seen from graph that the biggest ratio of unknown failures are caused by Kapak Elevator.







PROJECT DETAILS

Mold Changing Process

Process

In mold changing process usually there are 7 workers who are responsible for their own tasks. In every machine, there is at least one worker who is responsible for its mold changing operation. Only for kapak elevator machine there are two workers. Qualified operator starts from the kolileme operation and then proceed other operations respectively.

Describe Every Work Station and Define the Job Description for Mold Changing

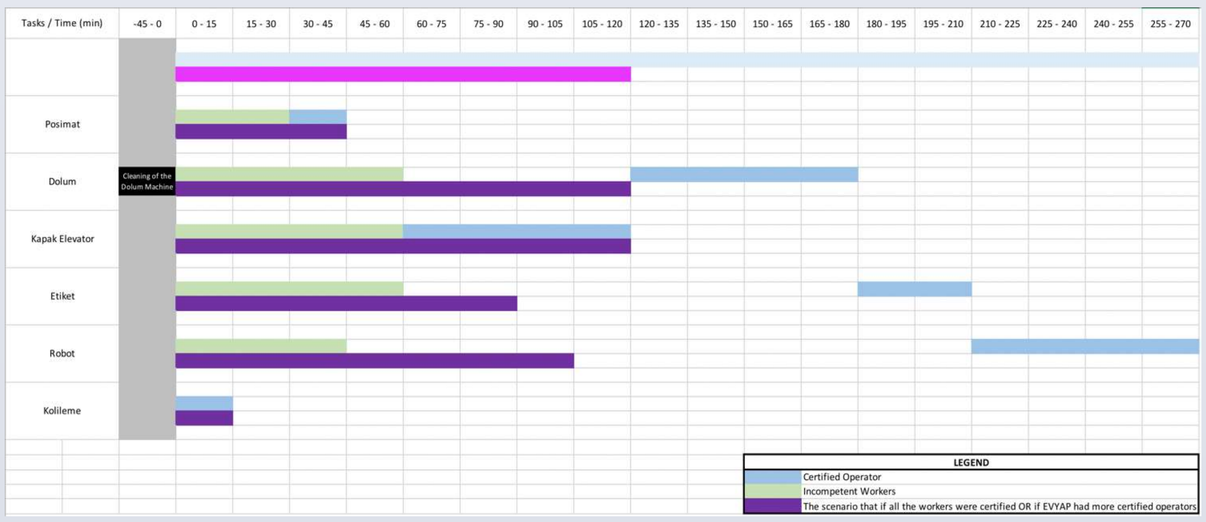
Posimat: There are approximately 25 molds inside of the Posimat machine. During the mold changing process the worker who have responsible for that machine, must change each mold which is found in that machine with the new molds. With this change , the new molds should be fixed to the machine with the help of a hammer.

After that, the machine which is called Orientor provides bottles to enter to the line with the same alignment. Because, otherwise, any positional mistake of the bottle causes a change in the stance of the bottle. The chips which are also identical for each product are used to adjust the Orientor machine. The worker should change these chips and control if the machine is working well or not. The last duty for this worker who is responsible from this work station is adjusting the line width according to the bottle width and fixing it whether it is too wide or small

- ***Kapak Elavator:*** On the Kapak Elevator part of the line, during the mold changing process, there are molds which are identical for each type of the cap. If the cap of the new product is different from the previous one, the worker should change each mold with the new one.
- ***Dolum*** **:** For the "Dolum" machine, before starting the mold changing process at this work station, the worker who is responsible from Dolum, should ensure that the machine is clean. Any amount of soap left in the Dolum machine will cause problems such as mixing the new product with the previous one or low quality of the new product. There are two things to be done before the mold changing at Dolum. One of them is outside washing and the other one is inside washing. This washing processes can be done by the faucet that is located inside the machine. After the washing processes, the worker has to wait until the machine become dry to make the new adjustment of the tube for the new product.
- ***Etiket :*** The labels are wrapped on the rolls and the worker have changed those rolls with the new ones. Since there might be few amounts of soap also left on the labels, the worker has a responsibility of cleaning it. The main responsibility of the worker for the label machine is to adjust the position of the rolls. Because of the unadjusted position of the rolls, the labels have the chance to be stacked to different places of the bottle with the lack of worker's control. Another responsibility of the worker for this station is entering the party number of the labels to the machine.
- ***Kolileme*** **(Qualified Worker):** The qualified worker who are able to perform the different tasks of different work stations is responsible to start from kolileme station for the mold changing operation. On the kolileme part, he adjusts the size of the packages and the technical requirements of that machine**.**
- ***Robot:*** The worker is responsible to adjust the movements of the robot which pick the boxes and put it in to the pallets, from the panel.

Problem:

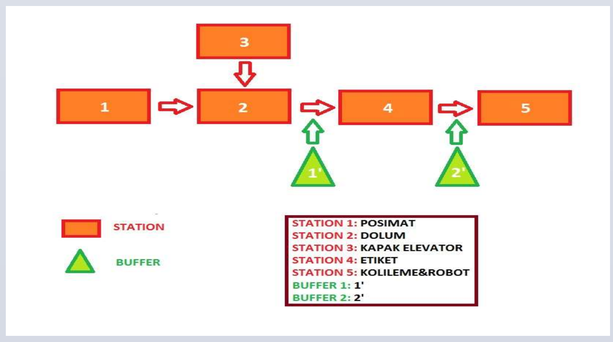
The main problem observed for the mold changing process is the extensive time spent for the mold changing application. According to our observations one of the biggest reason behind that was the lack of technical knowledge of the workers. As we mentioned above, there are specific tasks for each work station and every worker is responsible from a work station and from the tasks of this workstation to complete the mold changing process. Therefore, each worker has to conduct their own task at their work station and they need to do their tasks regularly in each mold changing process. In addition to that, after those regular tasks has been done, there are still some technical tasks remaining to be done. However, most of the workers are not able to complete those technical tasks because of their lack of technical knowledge. Therefore, they have to wait until the qualified worker who have the knowledge about all of the machines and the computers that are located next to machine, finishes his/her own work. He/She is the only one who are able to overcome on the technical adjustments and able to check all of the operations realized at different work stations. So, this situation generates a lot of work for him and causes the huge amount of loss of time. If the unqualified workers have done their tasks at their own station before the qualified worker finishes his own work, they have to wait for the qualified worker to complete his own work at his work station. While the qualified worker was working for a machine, let's say dolum machine, etiket machine should wait till his work on dolum machine done. Because the qualified worker is the only one who have the ability to control every work station and to implement technical adjustment, both workers and machines become idle most of the time. In addition to this, since most of the unqualified workers are not able to solve unexpected problems occurred during the mold changing processes, when some problems occurred, the production line become idle and workers start waiting for the qualified worker to become available and to solve the unexpected problem.



Train workers

One of the key point for the effective usage of the labor is flexibility which provides ability to shift the labor capacity to where it is needed. In some cases, the production plan or the number of workers needed for any operation may change because of some unexpected situations. Therefore, to reach the maximum efficiency from the labor and to overcome that kind of situation without a loss, workers should be able to work in every job station. Cross training improves the productivity and the utilization of workers by allowing a worker who idle at one station to switch another situation.
For the liquid filling line of EVYAP, we have observed that if each worker had the knowledge about the machines technical requirements and were able to solve any kind of trouble during their task, the total duration of the mold changing process would decrease around 120 minute.

Buffer



Because of downtime periods are far better shorter compared to other stations and the system can be recovered in a brief time period, we frown on putting a buffer between stations 1 and 2. The main reason for both buffers are keep the system working when there is a failure in the production line. The 1st buffer's primary objective is to store the impeccable products, and when there is an error in the Kapak Elevator, that is one of the most seen errors in the system, keeping the system online. Otherwise, today without the buffers; even if there is no jam in the Kapak Elevator and only "capping" application have failed, the workers need to manually put caps on the bottles in the line. Even this time period can be put in a good use on a different task. The 2nd buffer's primary objective is again storing the error-free products, and when an error occurs in the Kolileme & Robot (Robot refers to the mechanical arm which puts the product bundle into the packages.) station, that is one of the another most seen errors, maintaining the system. Any other way would conclude with a stoppage of the line.

Without the buffers; there would be a loss on the production. However, with the buffers; although the production might still be lost in a lower value, the effectiveness of the line will be increased (considering the "state" of the system as well).
•If station 4 stops and stations 1,2, and 3 are working; buffer 1 level will start to increase till it reaches its limit or station 4 resumes its work.
•If one of the stations 1,2, and 3 stops; station 4 will start withdrawing the product from buffer 1 and continue the production till the buffer is empty or the stations 1,2, and 3 continue their work.
•If station 5 stops and the production line before station 5 is working; buffer 2 level will start to increase till it reaches its limit or station 5 resumes its work.
•If the production line before station 5 stops; station 5 will start withdrawing the product from buffer 2 and continue the production till consummating it or the whole line continues its work.
•If the stations are up at the same state, the sizes of the buffers are not going to change.

Conclusion

We have offered different approaches and analysis for Evyap to increase the OEE rate of the liquid filling line. The most important result of the project was the detail analysis of the unknown failures which shows the statistical approach for unknown failures. For the next steps of the project, the unknown failures should be examined regularly to get a more accurate solution from the analysis. Type of the unknown failures should be also updated regularly. For the mold changing process, the more observation and the data record will give the better solution to reduce the mold changing time.