POLITECNICO DI TORINO

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Creation and Implementation of real Time Quality Software to increase the statistical study linking the Production and Quality

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Table of contents

List of Figures

CHAPTER 1

1.0   Introduction

Ahlstrom – Munksjö is a global company, that produces fiber-based products. More than 90% of products are made from renewable fibers. Ahlstrom was founded by Antti Ahlstrom in the year 1851 in Finland and Munksjö was founded by Janne Lundström & Lars Johan Hierta in the year 1862 in Sweden. In the year 2011, the company celebrated their 160th year anniversary. The company Ahlstrom & Munksjö merged together in the year 2017 and it forms Ahlstrom – Munksjö. It is one of the Europe's most innovative paper producer and It was delivering first class products to the worldwide customer.

The company operates in Europe, North & South America and also in Asia. The production Plants are mostly located in Europe and the sales offices are located in the respective regions all around the Europe, North America, South America, and Asia.

Figure 1.1 Ahlstrom – Munksjo Manufacturing Plant & Sales office

Ahlstrom & Munksjö's customer represents several industries such as Automotive, furniture, Construction, and Energy sectors.

1.1 Business Sectors:

Some of the few business sectors are

1. Décor
2. Filtration & Performance
3. Industrial Solutions
4. North America Speciality Solutions.
5. Specialities.

1.2 Mathi Production Plant:

Ahlstrom & Munksjö's Mathi Production Plant is located in the province of Turin, Piedmont. There are around 550 people are working in the plant and the turn over of around € 290 Million. There are two types of establishments are there in Mathi Production Plant. Namely

1. Superior Establishment
2. Inferior Establishment.

1.2.1 Superior Establishment:

In superior Establishment there four continuous machines, two super calendars are there, namely Voith Sulzer and Kleinwefers (KWF), Thermal Power Plant, and Filtration Units. The main product is the release paper, designed to support self-adhesive labels.

1.2.2 Inferior Establishment:

In Inferior establishment we can find a continuous machine for Production of filter papers, three production lines where the paper is saturated with resins to provide the properties of both the Mechanical & Thermal resistance, and there is also two Production lines are there for the Production of Synthetic filter fiber and the line of lamination on the produced filter paper. The Layout of the Mathi Production Plant is Shown in Figure 1.2.
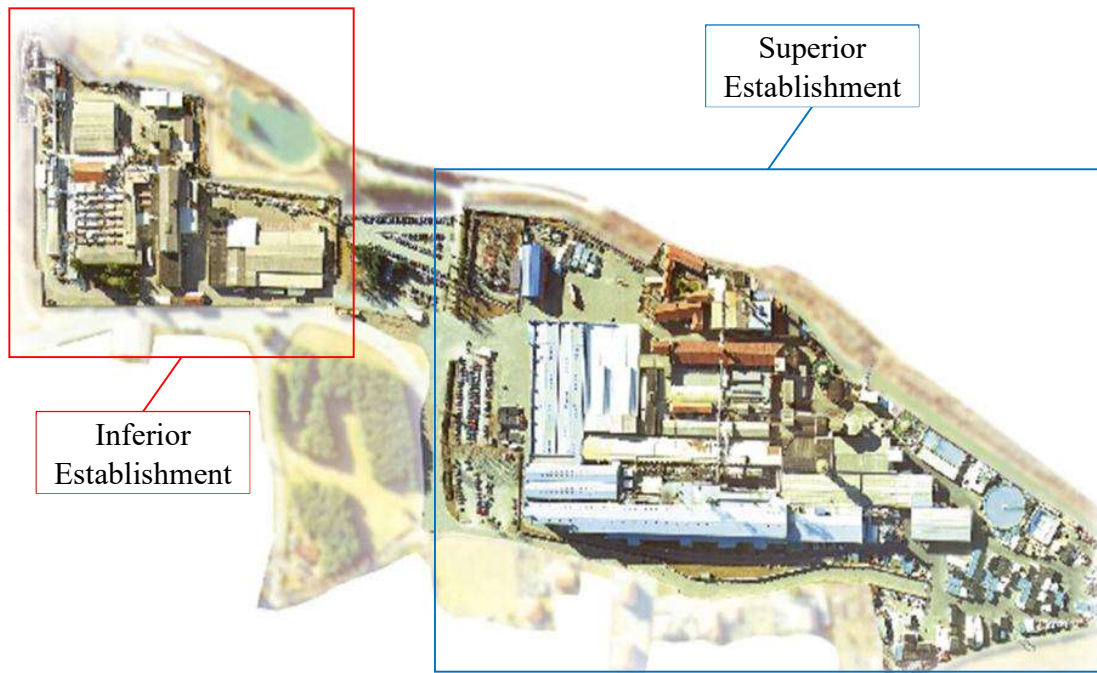
Figure 1.2 Layout of the Mathi Production Plant

1.3 Production Process

The Production Process are divided into five steps. Namely,

1. Refining & Coating Kitchen Section
2. Paper Machine 8
3. Super Calendaring
4. Cutting Section
5. Packaging Section
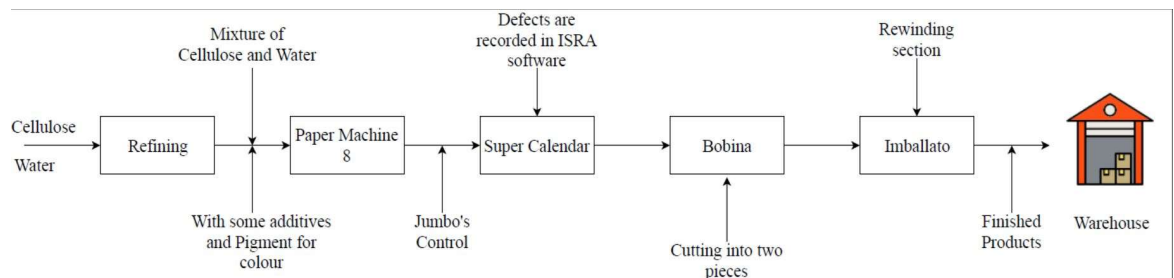
1.3 Production Process in PM8

1.3.1 Refining & Coating Kitchen Section:

Paper production is a two-step process in which a fiber ingredient is first converted into fibrous raw material and then converted to pulp. Pulp production can be done either mechanically or chemically. The pulp is then bleached and finished, which is the second version of the paper type to be used.

Initially the Polyvinyl alcohol is available in powder form and it gets mixed with water and heated with starch in a boiler at certain temperature of about 95℃ and the mixture is combined with the cellulose and water. Then it is transferred to the paper machine from the refining section (kitchen section) along with some additives and pigmentation for color has been added to that mixture. The switch of water and cellulose into the finished product takes place through a tidy process.

1.3.2 Paper Machine 8:

In the Paper Machine 8 (PM8) section, The Drain section composed of 48 cylinders and the cylinders are arranged sequentially. The drain sections are divided into two types. They are

1. Pre-Drain Section
2. Post-Drain Section.

In between the drain sections, the Oven is located. The purpose of the Oven is to remove the excess humidity that is presented in the paper that was coming out from the Pre-Drain section. Because of the sticking property of the paper coming out from the Pre-Drain section, the paper floats inside the oven. The Oven was maintaining with certain temperature.

After Coming out from the oven, the paper travels to the Post Drain section, where the water is sprayed to the paper to maintain the humidity. Then the finished paper goes to the super calendaring section.

In the post drain section, the ISRA vision Software is Installed and it records the defects on the produced paper. ISRA vision software fitted in Paper Machine 8 is only for the transmission purpose. The Figure 1.4 shows the layout of Paper Machine 8.

Figure 1.4 Paper Machine 8 Layout

After the paper coming out from the PM8, we check the quality of the paper by using the machine such as L& W Autoline 400 and L & W Micrometer.

By using L& W Autoline 400, We are checking the qualities of the paper such as,

1. Smoothness
2. Permeability
3. Color
4. Thickness
5. Tearing Strength
6. Moisture
7. Grammage/Basis Weight
8. Tensile / Roughness of the paper.

By using L & W Micrometer, we are checking the following qualities of the paper,

1. to measure the thickness of the Paper
2. to produce a superior quality product.

1.3.3 Super Calendaring Section:

In the next step, the produced paper should be sent to Super calendar for the finishing Process. The super calendaring process will improve,

1. The outer surface properties of the paper
2. It will give the glossy finish on the paper
3. It will improve the smoothness of the paper as well.

Figure 1.5 PM8   **Figure 1.5 Super Calander**
Figure 1.5 PM8 vs Super Calander

Figure 1.5 shows the differences between the paper comes from PM8 and from Super Calendar.

In the Super Calendar section, two Super Calendars are there, Namely Voith Sulzer and Kleinwefers (KWF). Each super calendars are fitted with two ISRA Camera's with different specifications.

1.3.4 Cutting Section:

After finishing from the super Calendaring Section, the finished product transferred to the Cutting Section. In the cutting Section two machines are there. They are,

1. Vari-Top
2. Vari-Flex.

These machines are used to Cut the jumbo rolls into two pieces and it gets transferred to the rewinding section.

1.3.5 Rewinding Section:

After cutting the Jumbo's into two pieces, rewinding process is done there in the Packaging section. We are using one machine in the Packaging section namely Vari-Roll. This machine is also fitted with ISRA vision Software and It is used for both the Transmission and Reflection purposes.

The finished product again monitored by the ISRA Scanner and with the help of automatic robot the finished product gets Wrapped and then It is transferred to the Warehouse for the Shipment.

1.3.6 Warehouse:

Finally the finished products are stored in the Warehouse. Depends on the requirements of the customer. The Products should be shipped to the customers.

1.4 Water Treatment Process:

The Paper Mill using some of the water treatment process to get water from the river. Few water treatment methods are,

1. **Sedimentation Technology:**
   It is the simplest and economical method of separating a solid substance from the liquid phase. During this Process High Efficiency is achieved.

2. **Biological Treatment:**
   It is used to designed to degrade pollutants dissolved in effluents by the action of Micro - Organisms. These Micro – Organisms utilize these substances to live and reproduce.

3. **Advanced & Tertiary Treatment:**
   It is used to remove specific wastewater constituents that cannot be removed by secondary treatment processes are necessary to remove Nitrogen, Phosphorous, additional suspended solids, refractory Organics or dissolved solids.

1.5 Planned Activities:

The Schedule of planned activities are done by using the Gantt Chart.

Year		2019			2020		
Month	Oct	Nov	Dec	Jan	Feb	Oct	
Planned Activities							List of Planned Activities
1							Introduction
2							Objective
3							Implemetation of RT Quality Software
4							Adding features into te RT Quality Software
5							Coding/Algorithm
6							Results obtained using Rt Quality Software
7							Conclusion

Figure 1.6 Shows the schedule of activities

CHAPTER 2

2. Objective:

To understand the production process in the Paper Machine, Super Calendars (Kelinwefers & Voith Sulzer), and in the Rewinding system and to create the Real Time Quality software to minimize the process of identifying the defects.

The main motto of this project is to create an automation of the Real Time Quality software, and a simple user interface in order to use this software program to identify different defects classes in the ISRA Software database, which is scanned during the production of paper.

The actual system is used to check the quality of paper created by the external company in a closed database, and the production and quality department cannot customize the Statistical Quality Control Process.

So, with the help of this Real Time Quality software, the company wants to read the database and to create a helpful platform in order to increase the statistical study linking the Production and Quality.

2.1 General description about ISRA Software in the Paper Machine, Super Calendar and Vari – Roll:

The main function of ISRA software is to identify the defects on the paper. One ISRA Vision camera is fitted on the Paper Machine. Two ISRA Vision cameras are fitted on the Super Calendars (ie., Voith & Keleinwefers) and finally another ISRA camera is fitted on the rewinding machine. The functions of each ISRA cameras are totally different.

When compared the ISRA vision software with the Super calendars and with the Paper Machine 8, The super calendaring has two different specifications for the each ISRA vision Camera's. The Specifications are as follows,

The ISRA VISION Camera in Paper Machine 8 and Kleinwefer are used only for Transmission purpose.

The ISRA VISION Camera in Voith Sulzer is used for both Transmission purpose as well as for Reflection purpose.

Currently the ISRA Vision software was updated with Quick Teach. It helps the system to identify the defect classes and add that defect to that specific category, and It was working based on the defect classes.

2.1.1 Identification of Defects on ISRA Software:

These are all the defect types from the ISRA Database. Based on the defects classifier options that are available on the ISRA Database. Based on the size of the defects, the software identifies the defects that are in the paper and allocate the defects under its category. Below image shows the Defect Classifier options and their area.

Quick Teach	Class Name	Class Constraints		
....	Inizio	All Defect types: MD		
....	Micoroforo	All Defect types: Area	AND	
....	Macch Chiara Micro	Bright Defects: Area		
No Group	Buco Grande	All Defect types: Area	AND	
No Group	Buco Medio	All Defect types: Area	AND	
No Group	Buco Piccolo	All Defect types: Area	AND	
QT Match not found	Macch Chiara Grande	Bright Defects: Area		
QT Match not found	Macch Chiara media	Bright Defects: Area		
QT Match not found	Macch Chiara formaz	Bright Defects: Area		
....	Macch olio Grande	Bright Defects: Area		
....	Macch olio Media	Bright Defects: Area		
....	Macch olio Piccola	Bright Defects: Area		
QT Match not found	Piega	All Defect types: Area		
QT Match not found	Fibra Legno	All Defect types: Area	AND Area	
QT Match not found	Macch Nera formaz	All Defect types: Area		
....	Macch Nera formaz	All Defect types: Area	AND Aspect Ratio	
....	Macch Nera formaz	All Defect types: Area	AND Aspect Ratio	
....	Macch Nera formaz	All Defect types: Area	AND Aspect Ratio	
....	Macch Nera formaz	All Defect types: Aspect Ratio		
....	Altro	All Defect types:		

Figure 2.1 Defects Classifier options

Based on that available information in the classifier options, If the defects are under >= 7, it will automatically come under Macchia Chiara Media. For Example,

Quick Teach: QT match not found.

Class Name : Macchia Olio Grande

Class Constraints: Area >= 38mm^2.

If the defect area is Greater than or equal to 38mm^2, the system automatically categorized the defect to Macchia olio Grande. For Example,

Quick Teach: QT Match found

Quick Teach: QT Match found

Class Name: Buco Grande:

Class Constraints: Bright Defects: Area $>= 12$ mm^2.

Figure 2.2 Oil Defect in the paper

Figure 2.3 Hole defect in the paper

2.2 Important factors to consider while producing paper:

Important factors we have to consider while producing papers are,

1. Size
2. Frequency
3. Typology of defect.

The Products which are manufacturing in Ahlstrom – Munksjo are based on silicon coated. At the produced paper the customer can add silicon on the top. Most of the time it is designed for silicon coated on the one side of the paper. Most preferably on the smooth side of the paper.

The customer of Ahlstrom-Munksjo takes the finished product and add silicon on the one side and they will receive silicon-based product. Apart from that the customers used to add some adhesives and laminate with the face stock. The finished product will be like the label.

Ahlstrom-Munksjo they are manufacturing three different types of color paper. They are,

1. White
2. Yellow
3. Yellow TS (Mixture of Yellow and Red).

2.3 Cutting of paper into the desired shape:

In order to cut the paper to the desired shape, the paper goes to the cylinder. The external part is removed and we have only the particular area (Perhaps the oval shape, Rectangular Shape, Circle, etc.,). And the final product sticks to the surface of the External Product. In this condition, the transparency is really important.

2.4 Types of Defects:

There are some defects which create difficulty to the next level. They are

1. Functional Defects
2. Visual Defects

2.4.1 Functional Defects:

The Main functional Defects are

1. Oil Leakage from the Paper Machine
2. Because of Insects
3. Some of the defects based on Contamination.

Figure 2.4 and 2.5 shows the Defects with Contamination and with Insects.
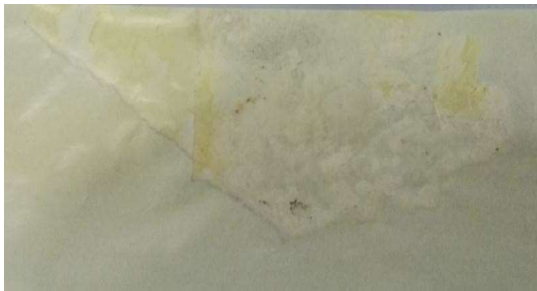
Figure 2.4 Defect with Contamination   **Figure 2.5 Defect with Insect**

2.4.2 Visual Defects:

There are some Visual defects that are available on the paper. Some of them are,

1. Holes – These defects leads to the breakage of the paper
2. Over Thickness
3. Lines
4. Stripes.

Figure 2.6 Defect with Lines and stripes

CHAPTER 3

3.1 Real Time Quality software:

The main use of this software is to extract the defects that are presented in the manufactured paper. The length of the paper that we are manufactured in our plant is approximately 72,000 km and weight is around 20t.

For a day we are manufacturing around 20 jumbo rolls and its not easy to calculate/count all the defects that are presented in the manufactured paper in the Paper Machine 8, and the defects that are found in the super calendar.

Previously, we collected all the jumbo rolls defect details as well as we pasted on the sheet in a sequential order to check the defects on the release liner paper. In order to simplify the steps to identify the defects in the PM8, Super Calendars and the rewinding machines are fitted with ISRA Vision camera's with different specifications and set ups. I explained the specifications and functions of the each ISRA vision software on the previous chapters.
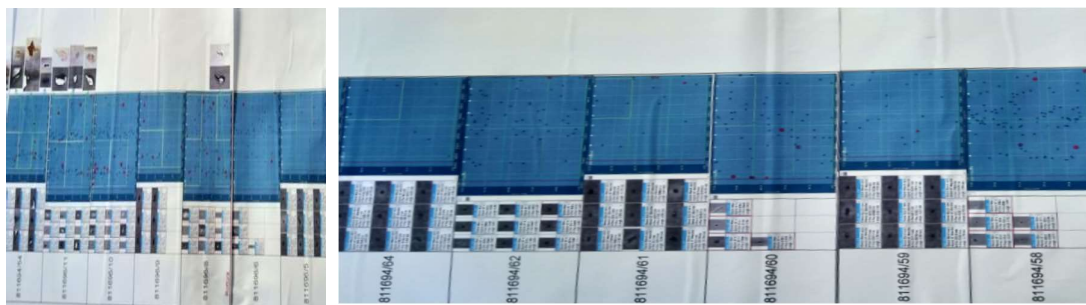
Figure 3.1 Previous method of collecting the defects details

The reason why we are going to implement Real Time Quality into our Paper Machine 8, Super Calendaring and in Rewinding Sections are, in order to make the production process ease and to improve the quality of the Production process. The Figure 3.1 shows the sample jumbo roll with all the defects on the produced liner paper. All the defects are identified based on the data entered on the defects classifier options in the ISRA vision database.
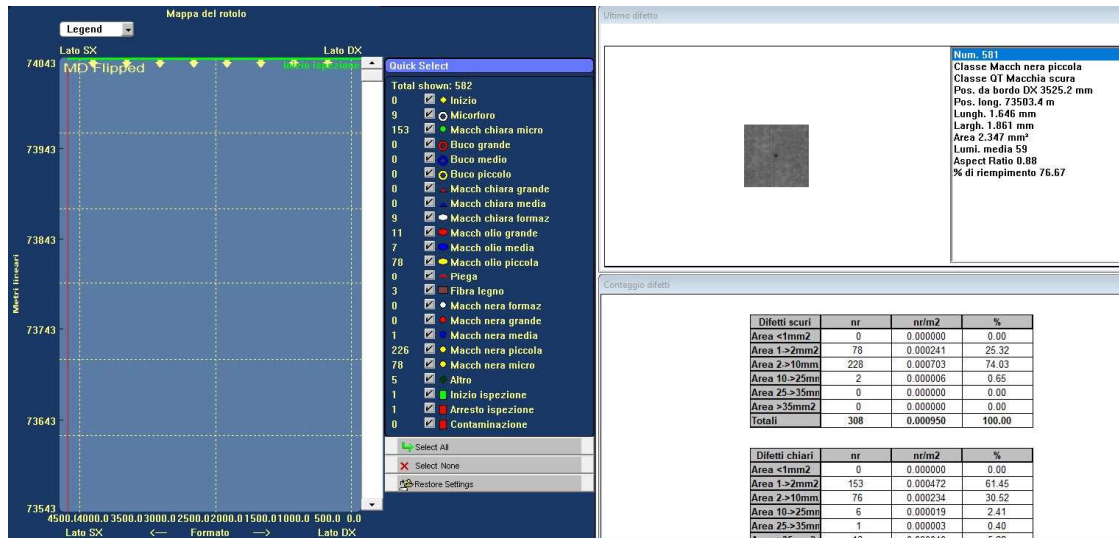
Figure 3.2 Sample Jumbo roll with all the defects.

3.2 Reasons for implementing Real Time Quality Software:

Before using the Real Time Quality Software, we did analysis on the paper manufactured on the PM8 and the super calanders Voith & KWF. The main moto of my analysis is, to identify only a specific defect called Macchia Nera Grande in both the super calander Voith & KWF.

I collected all the defect details about the Macchia Nera Grande from 14/10/2019 to 15/10/2019, because the defect Macchia Nera Grande increased rapidly during those days. Based on the data shown in the ISRA Vision software, I took details such as Exit time from the PM8 to the Super calendars, Product Number (Lotto), Count of Macchia Nera Grande from the Super Calendars (Voith and KWF).

From 14/10/2019 to 15/10/2019, there are 14 jumbo rolls are finished during that time. After examining all the details on the defects, with the help of Pivot table, I created a trend to analyze the defect Macchia Nera Grande which is increasing or decreasing. By seeing the trend, the defects in the Jumbo rolls in the super calanders is decreasing rapidly. Using the Linea option in the Pivot table, we can able to see the trend separately for the super calanders (VOITH & KWF).

Prodotto	Machia Nera Grande	Exit from PM8	Linea
811838/002	23	10/14/2019 17:22	VOITH
811837/058	41	10/14/2019 23:02	VOITH
811837/060	21	10/15/2019 1:19	VOITH
811837/062	75	10/15/2019 3:35	VOITH
811837/064	26	10/15/2019 5:50	VOITH
811837/065	11	10/15/2019 6:56	VOITH
811838/001	11	10/14/2019 16:09	KWF
811838/003	20	10/14/2019 18:34	KWF
811837/056	13	10/14/2019 20:49	KWF
811837/057	13	10/14/2019 21:56	KWF
811837/059	13	10/15/2019 0:09	KWF
811837/061	73	10/15/2019 2:28	KWF
811837/063	12	10/15/2019 4:42	KWF
811837/066	12	10/15/2019 8:03	KWF

Linea	VOITH
Row Labels	Sum of Machia Nera Grande
811837/058	41
811837/060	21
811837/062	75
811837/064	26
811837/065	11
811838/002	23
Grand Total	197

Figure 3.3 Trend of Macchia Nera Grande using Pivot table.

On 04/11/2019, I again counted the defects for the Bucco Grande and I plotted it as a trend using Pivot Table. It can be shown in the Figure 3.3,
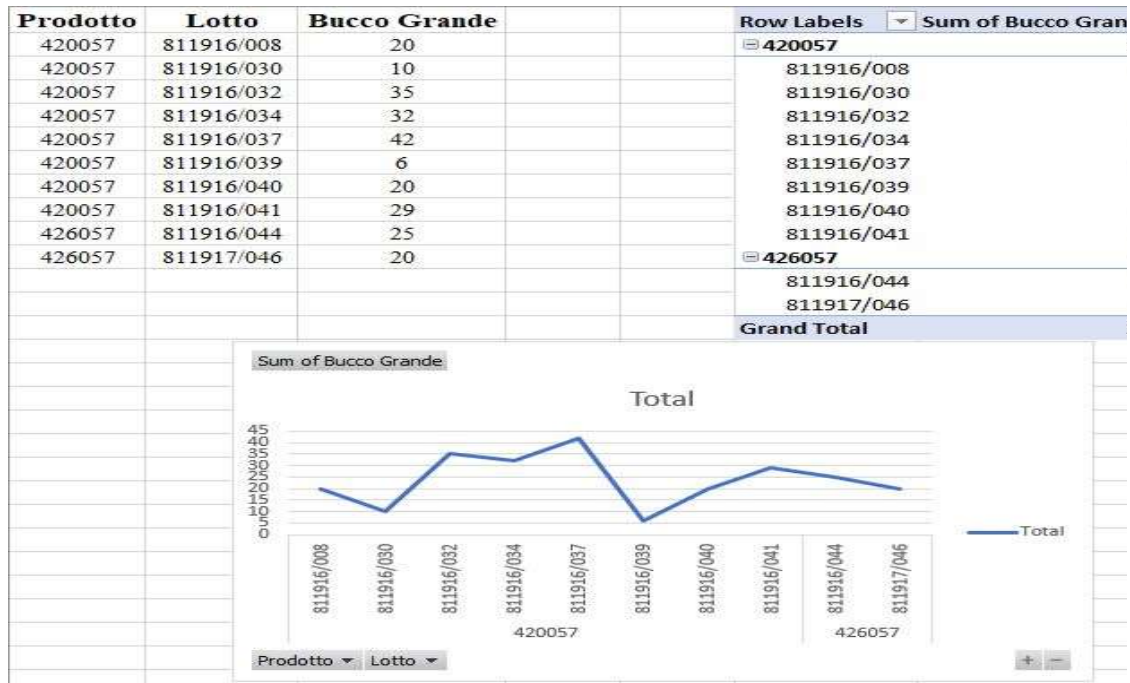
Figure 3.4 Trend of Bucco Grande using Pivot table.

So, like that we collected all the details of jumbo rolls as well as we arranged and pasted on the sheet in a sequential order with the help of carel mill software to check the defects on the release liner paper.

It consumes plenty of time to check and to collect all the defects types. By using this software, we can able to Minimize the time consumption for spending to check and to calculate the Count of defects on the release liner paper.

3.3 List of features implemented on the Real Time Quality software:

After I had the discussion with the Production Department and the Quality Department, I came to conclude that what are the steps that are needed to include on the real time quality software.

The software is programmed with following features,

1. It has to retrieve defects from the ISRA database in real and stores the information in the separate database
2. It shows the custom charts with real – time data, that focus on important trends for the quality department
3. It has to monitor and the retrieved the values to send reports and warnings to the Production & Quality department if the defects exceeds from the threshold
4. It allows to export data to excel based on some filters.

The software has to collect the data from the following machines,

1. Paper Machine 8
2. Super calendars (VOITH & KWF)
3. Vari – Roll (B637)

3.3.1. Retrive data from ISRA Vision software:

ISRA vision Software scans the Jumbos and detects the defects based on the defects classifier options. Some ranges of values are grouped together and define a certain category of defect.

For Example: Macchia Scura. The way defects are scanned and grouped together is configurable in the ISRA Vision software.

Based on the settings made, ISRA Vision software produces a *** .dft** file for each scanned jumbos that contains the list of detected defects. The file is formatted in comma separated values (.csv).

The analysis of these files requires too much computation to be used for real-time data visualization. So first of all, a Windows service must be developed, which collects only the useful data from the CSV files and store them into a separate database.

The service will be initialized to collect data from a specific day chosen as the start of use; subsequently, it will check periodically, if there are any new data to retrieve from ISRA and stores them into the database.

The data stored in the database will be then used by the Real Time Quality software to display as a trend on the monitor screen.

3.4 Working of Real Time Quality Software:

Using the ISRA cameras, we can able to identify the number of defects that are available on the jumbo rolls and total number of defects also we can able to identify on each jumbo roll. Always the ISRA cameras, that are fitted on the machine record all the defects and few of the defects are not so important to our customers.

In order to identify the defects more precisely, we entered the specification limits of the defects using the defects classifier options in the ISRA vision software. So, the defects classifier options will sort it out the defects and kept under the defect's types. The defects classifier options are available on the Chapter 2 and the Figure number is 2.1.

From the figure 3.2 & 3.3, we can clearly see the work we are doing before to identify the defects count is a tedious process. In order to count the defects in the more efficient way, the automation of this software will help.

Like I already mentioned, the length of the paper that we are manufacturing is 72,000 km approximately and the weight is around 20t. It is not possible to count the defects manually and visually. If we start to calculate all the defects, it will take few years to count all the defects in the jumbo rolls. So, for one jumbo roll it will take one year to complete it, then think we are manufacturing approximately 20 jumbos per day (10 alone from the Super Calendars). It is not easy to count all the defects in the jumbo rolls manually and visually.
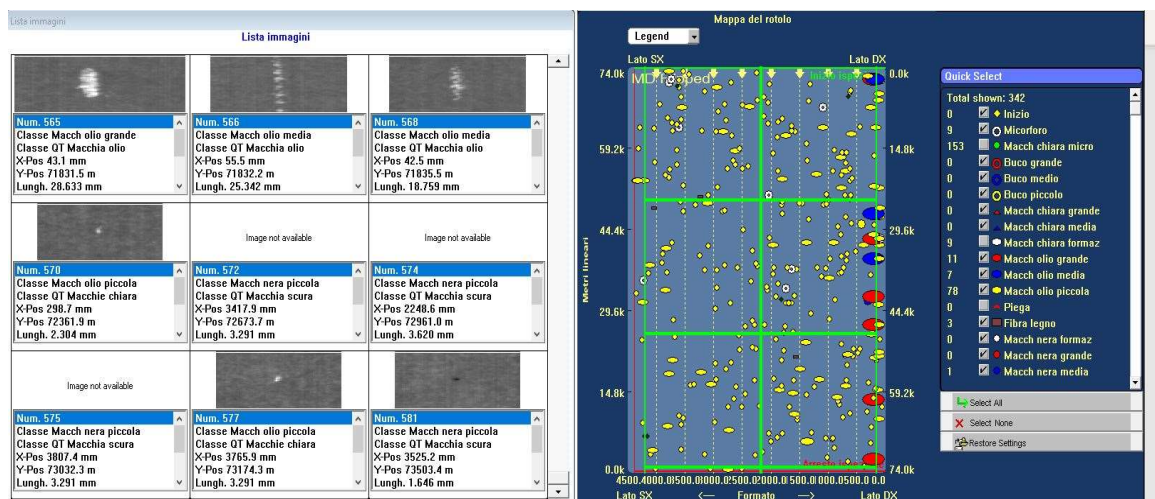
Figure 3.4 ISRA Defects map.

Figure 3.4 represents the ISRA Map with the defect's details on it. On the left side of the map, we can see that the list of defects that are available on the jumbo roll and it is clearly showing the Number of defects, Classification of defects along with the images, and it also represents the Position of the defects in X and Y axes.

On the right side of the map, it shows the total area of the paper along with its length as well as we can see that the list of defects that are available on the paper. We are using only the region in between green border; An excess part will be removed in the cutting section.

By using the Real Time Quality Software with the help of ISRA vision software (where the defects are saved in the ISRA database).

The main motto of this software is to extract the only the few important defects such as,

01. Inizio
02. Micorfono
03. Macch Chiara Micro
04. Buco Grande
05. Buco Medio
06. Buco Piccolo
07. Macch chiara grande
08. Macch olio grande
09. Macch olio media
10. Macch olio piccolo

And with the help of CARELMIL software, the Real Time Software has to arrange the sequential order of the finished jumbo rolls and it has to produce the output along with the ISRA database.

This program is based on by entering, we have to enter the starting date and ending date of the jumbo rolls that we need to examine the defect counts, then we can able to identify the defect counts from the jumbo rolls based on the manufactured date and time.

As well as the real time quality software will calculate the defects based on defects per m^2 in the produced paper.

After collecting all the defect types and its counts, the software can export these data into the excel file. Using that excel file, the production and the quality team based on the defects counts on each defects, it helps us to make it as trend for various defects and help us to compare in terms of both production and quality as well as it helps us to compare the trends with the customer standards, and we can able to improve the quality of our products and we can able to minimize calculating the defects and obviously it's a time saving process when compared to the previous method of calculating the defect.

CHAPTER 4

4. Automation for Real Time Quality Software:

In order to create the automation part, With the help of Information Technology team of Ahlstrom -Munksjo, I Created the Real Time Quality Software.

There are three steps in the Automation Part for the Real Time Quality Software. They are,

1. Fault Type Calculator
2. Params. Properties
3. Startup. Bait.

4.1 Fault Type Calculator:

It is the heart of the computer program. We team together and created .jar file. The .jar file is gets connected with the Ahlstrom-Munksjo's server, and the software is extracting the defects details from the online server.

4.2 Params. Properties:

It contains the Main Program configuration. We can open it with the Notepad and we can able to edit the filter types we want, Starting and Ending value ranges, Start date and End date of the Production process (No. of jumbo rolls).

4.3 Startup Bait:

The main function of this Program is, after collecting all the details such as Defects types, Starting and Ending value ranges, Start date and end date of the production process (No. of jumbo rolls). After entering all the required data on the Params. Properties, We have to Save it and we have to launch the Start up bait.

4.4 Steps to process the Automation of Real Time Quality:

4.4.1 Params. Properties:

Figure 4.1 Selecting a program to open the file

I already mentioned in the above step that, we have the Params. Properties file using the Notepad. After clicking it shows the above Figure 4.1 from there, we have to click **Select a Program from a list of installed programs.** After clicking ok, It opens another dialog box from there, we have to select the **Notepad**, shows in the figure: option and then we click okay.
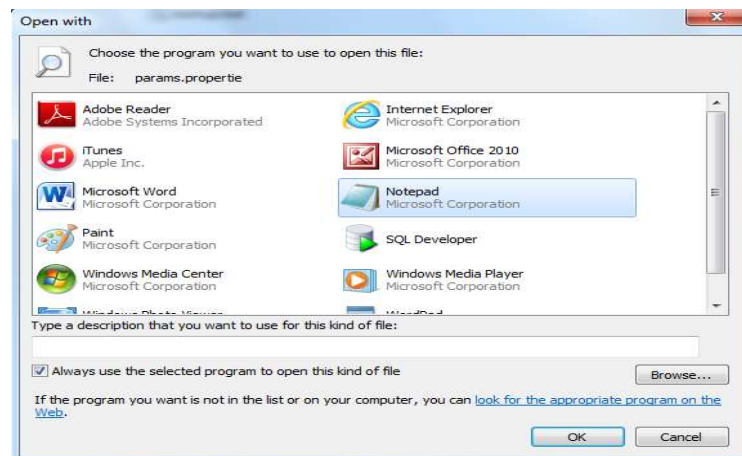
Figure 4.2 Selecting Notepad

Finally, The Notepad opens the programming file. The programming file is shown below in the table.

#this is the first day (format: YYYY-MM-DD)
#this is the last day (format: YYYY-MM-DD)
#ranges definition
#separate each range with;   For Example ranges = **1;6.25;10;20;1000**
#filters   #unify filters with & and separate with ;
#Example: "Macch near &Fibra; Macch chiara" means that you want unify results   **#   for "Macch nera" and "Fibra", and then you want also results for**   **#   "Macch chiara"**
#if you specify just "Macch", the filter unify all   #   the faults that contains the word "Macch"   filters = **Macch nera grande & Macch nera piccolo & Macch nera micro & Fibra; Macch chiara piccolo & Macch chiara media & Macch chiara grande & Traslucido & Macch olio; Micorforo; Altro**
#average length of the reel
#this is used when it's not possible to extract the length of the current reel
average length = **65000**
Program file

On the programing file, we have to enter the starting date and ending date of the manufactured jumbo rolls details. Here, we already designed that the software has to identify the defects based on the ranges that we entered on the simulation.

We set up a filter about the defect's details, and those are the Major defects that the software has to identify and it has to show as an output.

The Average length of the Jumbo rolls can Varies from each other i.e. for Instance, in case of web Breaks, so we can put a value to standardize the analysis in order not to have a

wrong calculation for very short jumbo roll with some un real defects caused because of the web break.

4.4.2 Explanation for the Definitions of the Programming file:

Start Date   The start date from which to start examining ISRA's files. It must be written in the format YYYY-MM-DD (year-month-day).

End Date   The date of the last day of which you want to examine ISRA's files. It must be also written in the format YYYY-MM-DD (year-month-day).

Ranges   It represents the intervals in which to subdivide the areas for the calculation of defects by area. Each number that is written represents the values LESS AND EQUAL to the number.

For example, if 1 is the first number, it means that the first range takes values for the areas between 0 and 1. Each number must be separated from the others by a semicolon. The last number does not require a semicolon. Area values higher than the last number are discarded; for example, if 1000 is the last number, area values greater than 1000 are discarded.

Filters   It represents the types of defects that you want to take into consideration. If you want to combine several types of defects in a single filter, you must separate the names of the various defects with an ampersand (&).

For example, if you want to consider black spots and wood fibers together, the corresponding filter will be: **Black spots & Fiber.** Each filter you want to specify must be separated from the others by a semicolon.

It is possible not to specify the entire name of the defect **(Ex: Small black spot, Large black spot)**, just a part of it (Ex: to consider all black

spots it is not necessary to specify "Small black spot & Large black spot & Micro black spot" ", But just specify" Black spot ", which is a part common to all these types of defects).

Average length	It represents the average length of the rolls examined; it must be specified because in some ISRA files the roll length is not specified. In this case, the average length specified here (in meters) is taken as the roll length. In some cases, the length of the jumbo would be variable because of the web break or with the different length because of the grammage of the paper.

4.5 Simulation the Program:

In order to obtain the results, we have to open the Params file, Right click on it, when you right click on it, New dialog box will open.,

Open ➔ Params (right click on it) ➔ New Dialog Box will open ➔ Select **Edit**

On the above dialog box, we have to enter the starting date and we have to enter the finishing date. Within that date, we have to add some filters options like the types of defects are available on the defect classifier options on the ISRA Software database. After saving everything manually in the software (Ctrl + S), we should run this automation software.

```
C:\\Users\Desktop\Paper_Machine8\SuperCalander>rem net use \\141.127.51.30
C:\\Users\Desktop\Paper_Machine8\SuperCalander>Java-Jar FaultTypeCalculator.jar \\141.127.51.30\Wiscal\Data
Loading Files....
                Exploring Day 2020-10-04....
                Exploring Day 2020-10-05....
                Exploring Day 2020-10-06....
                Exploring Day 2020-10-07....
                Exploring Day 2020-10-08....
                Exploring Day 2020-10-09....
                Exploring Day 2020-10-10....
                Exploring Day 2020-10-11....
                Exploring Day 2020-10-12....
                Exploring Day 2020-10-13....
                Exploring Day 2020-10-14....
                Exploring Day 2020-10-15....
                Exploring Day 2020-10-16....
```

Figure 4.3 Simulation of the program

While running the Automation program, the software collects the data from the Ahlstrom-Munksjo's server from the start date to the End date that we mentioned it on the Notepad. Then the program starts to explore the Ahlstrom-Munksjo's database on that IP address, and it starts to analyses all the days that we requested in between the Start and the End Date, it can be shown on the Figure 4.3 Simulation of the Program.

After that, as per the request made by us, Real Time Quality Software Explores all the days, and identifies the Jumbo rolls finished during those days. It separates all the defects that we entered in the notepad section and counts all the defects. Finally, it compiled all the details together and produces the Output in the form of .csv file and we can able to open the output using MS Excel.

CHAPTER 5

5.1 Output/Results:

After running the software, the it will collect the data from the server of Ahlstrom – Munksjo and displays the results like this,
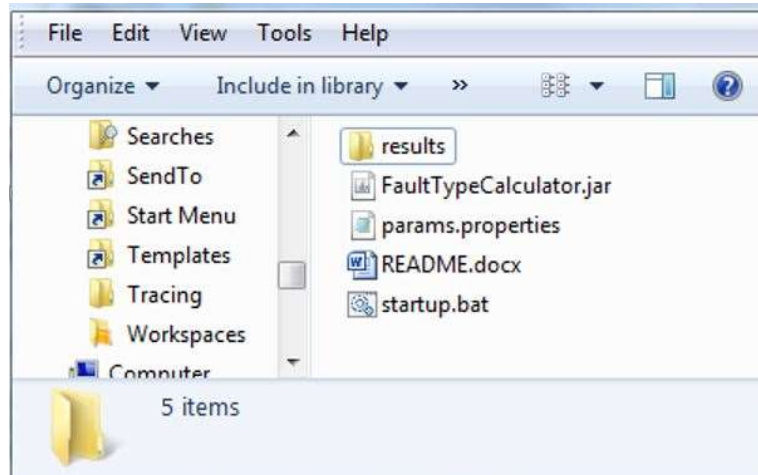
Figure 5.1 Results

There we can check the defects details such as No of Defects on the Particular defects, etc., Both the simulation and Output are shown in the Figure 5.1 & Figure 5.2 respectively.

The results are shown based on our requirements of defects data that we entered during the simulation. All the defects are displayed in a separated excel files such as (Macch Nera Grande, Macch Nera Grande, Macch olio Grande) and along with that, the simulation produces the compilation of all defects in a single file as Final Report.

The results will be displayed in the form of,

Figure 5.2 Display of results

5.2 Output Explanations:

5.2.1 Final Report:

After opening the Real Time Quality Software, we have o enter the Start Date and End Date to know the defects details Precisely. Here, I explained it based on the Output produced by the Real Time Quality Software.

Figure 5.3 Final Report

1. Starting Date and Ending Date of the Analyzed period
2. Total area of the jumbo roll

3. The real time Quality software calculates defects based on Number of Defects / 1000m^2.

   Based on the area that we mentioned before, the Real Time Quality Software identifies the defects based on their ranges, It displays the defects on the ranges of area such as 1, 6.25, 10, 20, 1000.

The unit of all the values from B7 to G10 is (Number of Defects / 1000m^2) it was displayed on cell A5. From B6 to G6, we have the ranges of sizes of the defects, which means that on Column B.

5.2.2 Macchia chiara piccola & Macchia chiara Media:

A	B (Column1)	C (1)	D (2)	E (3)	F (Date)	G (Web)	H (Rotolo)	I (Product)	J (Surface area)	K (1)	L (6.25)	M (10)	N (20)	O (1000)	P
1	67	0	3	1	04/10/2020	3E+05	1	819221	2127201623	47	315	0	141	47	,
1	110	9	7	5	04/10/2020	3E+05	1	819220	31590497	32	3482	285	222	158	
0	105	11	2	3	04/10/2020	4E+05	1	819219	316795092	0	3314	347	63	95	,
2	114	12	1	2	04/10/2020	4E+05	10	819219	3171190565	63	3595	378	32	63	
1	123	0	2	2	04/10/2020	4E+05	11	819219	3160710707	32	3892	0	63	63	,
1	85	12	4	2	04/10/2020	4E+05	13	819219	3159575351	32	269	38	127	63	
1	85	9	7	1	04/10/2020	4E+05	4	819219	3169105238	32	2682	284	221	32	
0	78	7	6	2	04/10/2020	4E+05	46	819218	317639224	0	2456	22	189	63	,
2	108	9	4	0	04/10/2020	4E+05	5	819219	275942222	72	3914	326	145	0	,
0	160	10	2	5	04/10/2020	3E+05	6	819221	3162908881	0	5059	316	63	158	,
0	108	4	4	2	04/10/2020	4E+05	7	819219	2754053689	0	3921	145	145	73	,
1	127	16	8	3	05/10/2020	4E+05	1	819223	3164545649	32	4013	506	253	95	
0	110	15	5	0	05/10/2020	4E+05	10	819222	3164717286	0	3476	474	158	0	,,
1	114	18	4	0	05/10/2020	4E+05	11	819222	3184924925	31	3579	565	126	0	,
1	125	5	0	0	05/10/2020	4E+05	2	819222	3163118122	32	3952	158	0	0	,,
0	99	10	2	2	05/10/2020	4E+05	3	819223	3159854211	0	3133	316	63	63	,
0	74	6	0	2	05/10/2020	3E+05	4	819221	2107418797	0	3511	285	0	95	,,
1	107	4	3	0	05/10/2020	4E+05	4	819222	3173360825	32	3372	126	95	0	,
1	117	5	8	0	05/10/2020	4E+05	6	819222	3167043116	32	3694	158	253	0	,
1	177	10	3	3	05/10/2020	3E+05	8	819221	3163517329	32	5595	316	95	95	
0	131	7	1	2	05/10/2020	4E+05	8	819222	3162736293	0	4142	221	32	63	,
1	131	12	3	2	05/10/2020	4E+05	8	819223	3158672299	32	4147	38	95	63	
0	117	2	4	6	06/10/2020	4E+05	10	819223	3154914462	0	3708	63	127	19	,
2	130	8	2	0	06/10/2020	4E+05	12	819222	3162559451	63	4111	253	63	0	,
1	112	10	8	0	06/10/2020	4E+05	12	819223	3164367597	32	3539	316	253	0	,
0	156	11	2	0	06/10/2020	4E+05	14	819222	31561424	0	4943	349	63	0	,,
1	131	12	2	1	06/10/2020	4E+05	15	819222	3149510848	32	4159	381	64	32	
0	163	4	2	0	06/10/2020	4E+05	17	819222	3169919002	0	5142	126	63	0	,,
0	131	8	3	3	06/10/2020	4E+05	19	819222	3157264175	0	4149	253	95	95	,
4	173	8	1	3	06/10/2020	4E+05	21	819223	3159677283	127	5475	253	32	95	
1	135	5	9	2	06/10/2020	4E+05	22	819222	3160199615	32	4272	158	285	63	
2	139	11	8	7	06/10/2020	4E+05	23	819223	315014781	63	4412	349	254	222	

Row 1 header: Numero Difetti;;;;;"Identificazione";;;;;"Numero di difetti su 1000 m2";;;;;

Figure 5.4 Macchia chiara piccola & Macchia chiara Media

Column F	:	Production Date
Column G	:	Product grade
Column H	:	Jumbo Roll
Column I	:	Making of the Jumbo Roll
Column J	:	Total Surface of the jumbo Roll
Columns K-O	:	Number of defects in the ranges identified in cell A2

5.2.3 Macchia Nera Grande & Macchia Nera Piccola:

Numero Difetti;;;;;"Identificazione";;;;;"Numero di difetti su 1000 m2";,,,,,	Column1	_1	_2	_3	_4	_5	_6	7	8	_9	_10
					Date	Web	Roto	Produ	Surface area	1	6.25
463	881	29	9	6	04/10/2020	325058	1	819221	2127201623	21766	41416
655	1365	16	2	0	04/10/2020	325059	1	819220	31590497	20734	43209
511	822	11	3	2	04/10/2020	426060	1	819219	316795092	1613	25947
453	672	15	0	6	04/10/2020	426060	10	819219	3171190565	14285	21191
452	609	23	3	0	04/10/2020	426060	11	819219	3160710707	14301	19268
394	636	7	2	0	04/10/2020	426060	13	819219	3159575351	1247	20129
411	576	8	3	0	04/10/2020	426060	4	819219	3169105238	12969	18175
499	854	20	2	0	04/10/2020	426057	46	819218	317639224	1571	26886
375	600	27	6	0	04/10/2020	426060	5	819219	275942222	1359	21744
894	1676	41	4	2	04/10/2020	325058	6	819219	3162908881	28265	52989
373	524	13	2	2	04/10/2020	426060	7	819219	2754053689	13544	19026
951	1867	22	2	8	05/10/2020	426060	1	819223	3164545649	30052	58997
934	2040	22	4	10	05/10/2020	426057	10	819222	3164717286	29513	64461
960	2008	25	14	16	05/10/2020	426057	11	819222	3184924925	30142	63047
912	1702	14	2	0	05/10/2020	426057	2	819222	3163118122	28832	53818
994	1976	18	6	5	05/10/2020	426060	3	819223	3159854211	31457	62535
597	1208	13	2	3	05/10/2020	325058	4	819221	2107418797	28328	57321
992	2040	21	1	0	05/10/2020	426057	4	819222	3173360825	3126	64285
884	1756	24	5	4	05/10/2020	426057	6	819222	3167043116	27912	55446
830	1733	17	2	0	05/10/2020	325058	8	819221	3163517329	26237	54781
1046	1981	24	10	4	05/10/2020	426057	8	819222	3162736293	33073	62636
847	1645	28	4	12	05/10/2020	426060	8	819223	3158672299	26815	52079
1557	3145	29	10	11	06/10/2020	426060	10	819223	3154914462	49352	99686
1313	3015	22	2	10	06/10/2020	426057	12	819222	3162559451	41517	95334
1207	2561	25	2	1	06/10/2020	426060	12	819223	3164367597	38143	81932
1290	2977	21	8	2	06/10/2020	426057	14	819222	31561424	40873	94324

Figure 5.5 Macchia Nera Grande & Macchia Nera Piccola

5.2.4 Microfori:

|	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1	Numero Difetti;;;;;"Identificazione";;;;;"Numero di difetti su 1000 m2";,,,	Column1	1	2	3	4	5	6	7	8	9	10	11	12	13	14
2						Date	Web	Rotolo	Product	Surface area	1	6.25	10	20	1000	
3	262	70	0	0	0	04/10/2020	325058	1	819221	2127201623	12317	3291	0	0	0	
4	603	175	0	0	0	04/10/2020	325059	1	819220	31590497	19088	554	0	0	0	
5	653	97	0	0	0	04/10/2020	426060	1	819219	316795092	20613	3062	0	0	0	
6	356	83	0	0	0	04/10/2020	426060	10	819219	3171190565	11226	2617	0	0	0	
7	497	107	0	0	0	04/10/2020	426060	11	819219	3160710707	15724	3385	0	0	0	
8	375	68	0	0	0	04/10/2020	426060	13	819219	3159575351	11869	2152	0	0	0	
9	591	91	0	0	0	04/10/2020	426060	4	819219	3169105238	18649	2871	0	0	0	
10	642	121	0	0	0	04/10/2020	426057	46	819218	317639224	20212	3819	0	0	0	
11	454	95	0	0	0	04/10/2020	426060	5	819219	275942222	16453	3443	0	0	0	
12	96	39	0	0	0	04/10/2020	325058	6	819221	3162908881	3035	1233	0	0	0	
13	477	86	0	0	0	04/10/2020	426060	7	819219	2754053689	1732	3123	0	0	0	
14	37	14	0	0	0	05/10/2020	426060	1	819223	3164545649	1169	442	0	0	0	
15	92	27	0	0	0	05/10/2020	426057	10	819222	3164717286	2907	853	0	0	0	
16	81	28	0	0	0	05/10/2020	426057	11	819222	3184924925	2543	879	0	0	0	
17	223	63	0	0	0	05/10/2020	426057	2	819222	3163118122	705	1992	0	0	0	
18	39	11	0	0	0	05/10/2020	426060	3	819223	3159854211	1234	348	0	0	0	
19	74	17	0	0	0	05/10/2020	325058	4	819221	2107418797	3511	817	0	0	0	
20	90	28	0	0	0	05/10/2020	426057	4	819222	3173360825	2836	882	0	0	0	
21	64	29	0	0	0	05/10/2020	426057	6	819222	3167043116	2021	916	0	0	0	
22	98	32	0	0	0	05/10/2020	325058	8	819221	3163517329	3098	1012	0	0	0	
23	79	30	0	0	0	05/10/2020	426057	8	819222	3162736293	2498	949	0	0	0	
24	39	28	0	0	0	05/10/2020	426060	8	819223	3158672299	1235	886	0	0	0	
25	50	19	0	0	0	06/10/2020	426060	10	819223	3154914462	1585	602	0	0	0	
26	62	18	0	0	0	06/10/2020	426057	12	819222	3162559451	196	569	0	0	0	
27	33	27	0	0	0	06/10/2020	426060	12	819223	3164367597	1043	853	0	0	0	
28	55	27	0	0	0	06/10/2020	426057	14	819222	31561424	1743	855	0	0	0	
29	56	27	0	0	0	06/10/2020	426057	15	819222	3149510848	1778	857	0	0	0	
30	75	25	0	0	0	06/10/2020	426057	17	819222	3169919002	2366	789	0	0	0	
31	58	19	0	0	0	06/10/2020	426057	19	819222	3157264175	1837	602	0	0	0	
32	68	22	0	0	0	06/10/2020	426057	21	819222	3159677283	2152	696	0	0	0	
33	68	34	0	0	0	06/10/2020	426057	22	819222	3160199615	2152	1076	0	0	0	
34	51	19	0	0	0	06/10/2020	426060	23	819223	315014781	1619	603	0	0	0	
35	193	58	0	0	0	07/10/2020	420058	2	819226	3148343251	613	1842	0	0	0	
36	286	70	0	0	0	07/10/2020	420058	1	819225	3147911936	9085	2224	0	0	0	
37	294	95	0	0	0	07/10/2020	420058	2	819225	3141161168	936	3024	0	0	0	

Figure 5.6 Microfori

In figure 5.6, The micorfori values are from the column M to Column P. Most of the microfori values are always 0 (Zero) because, the values of micorfori are always very small. Due to this value is very low, reporting it in m^2 representation, the value became very often zero with a lot of zero as decimal, so we can approximate it as Zero (0).

CHAPTER 6

6.1 Conclusion

Previously, we collected all the defects details from all the jumbo rolls separately from the PM8, and super calendars, and we arranged it on a sequential order to get the clear ideas of where and from which jumbo the defects are in high numbers.

It took us lot of time and it's a tedious process. In order to collect all the defects in the Jumbo rolls, it took around a day.


Figure: 6.1 Manual output of the project

Figure 6.1 shows the manual output of the project.

Our Paper Mill is running 24x7 and each day we are manufacturing around more 20 jumbo rolls. It is not easy for us to collect all the defect details from PM8 and super calendars. In order to collect defect data, we have to refer the finished jumbo rolls details with ISRA vision software, and we have to get the date and time of finished jumbo using the CARELMIL software that is connected together. If we miss anything while counting the defects number, we have to calculate the defect details from the first. So, it will be the hectic process of getting the results.

By using this Real Time Quality Software,

1. We can able to minimize the time consumption for finding the defects details.
2. We can Improve the Production Process Efficiently.
3. We can improve the Quality of the paper by identifying the defects more precisely.
4. It helps the Production and Quality Department to focus more on the production process.

The output can be shown inform of the Excel file, from that file we can able to get the clear view of how many defects are present on each jumbo roll and what are the defects are there in each jumbo roll as well.

Below image shows the overall output of a single jumbo roll of the Real Time Quality Software.

	A	B	C	D	E	F	G	H
1	Start Date	10/4/2020						
2	End Date	10/27/2020						
3	Total Area	73976541.9						
4								
5	Defects/1000mm2							
6								
7	Filter name/ Range	1	6.25	10	20	1000		
8	Inizio	0.1707	0.1905	0.0224	0,0287	0.1363		
9	Micorforo	0.0552	0.048	0	0	0		
10	Macch Chiara Micro	4.8553	0.5861	0	0	0		
11	Buco Grande	0	0	00,0013	0	0.0016		
12	Buco Medio	0	0	0	0.0013	0.0003		
13	Buco Piccolo	0	0.0057	0	0	0		
14	Macch chiara Grande	0	0	0.0032	0	0.0148		
15	Macch Chiara Media	0	0	0	0.0047	0.0006		
16	Macch Chiara formaz	0	0	0	0	0		
17	Macch olio Grande	0	0	0	0	0.0287		
18	Macch olio Media	0	0	0.0085	0.006	0.0098		
19	Macch olio Piccola	0	0.1098	0	0.0028	0		
20	Piega	0	0.0322	0.0032	0	0.0003		
21	Fibra Legno	0	0	0	0.0028	0		
22	Macch Nera Formaz	0	0	0	0	0.0003		
23	Macch Nera Grande	0	0	0.0338	0	0.0022		
24	Macch Nera Piccola	0	1.1312	0	0.0076	0.0035		
25	Macch Nera Micro	4.3635	38,833	0	0.0054	0		
26	Altro	0	0	0	0	0		
27								
28								

Figure 6.2 Overall output

To be more precise, Real Time Quality Software helps us to identify the number of defects on the Jumbo rolls and collection of defects are based on Time Horizon, and it leads to the Manufacturing Execution Systems.

The Time Horizon, and Manufacturing Execution System acts as a better tool to collect the list of defects details on the Production Process.

And an Implementation of this Manufacturing Execution System in to our production Process leads us to,

1. An increase of Production Process
2. An Increase of Quality of our Production
3. Increases the Efficiency.

Real Time Quality Software helps the Production & Quality department to focus on creating more values through analysis.

After an Implementation of this Real Time Quality Software into our daily usage, it transformed the Production Process from Manual to Digital, and it helps us to focus on te competitive advantage that we gained.

And still we have some plans to add extra features on this Real Time Quality Software such as,

1. Adding the filters to separate the defects on the jumbo rolls
2. To display the live status of Production on Dry and Wet End Control Rooms, Daily Meeting Rooms, Super Calendar Sections as well as in Rewinding Sections like MS office presentations, etc.,

An ISRA Software Counts, Record and Classify the defects but it would be helpful to Grasp these data from ISRA database in order to use and Manipulate the density of the defects, and removing some other information because thinking about problems with Long term analysis, this software didn't help us so much.

So, It grasp what is relevant and to manipulate this information, it can help us to identify a Quality deviation and can help us reducing the time needed to create a trends, and we are dedicating more time to find a solution in case of deviation.

So, this Real Time Quality Software helps us to focus on the Real problem and not losing time to organize data.