SAP ERP Lay Planning Management Workbench For MAS Holdings

Solution for SAP Apparel and Footwear Manufacturing Plants

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Dissertation submitted to the Faculty of Information Technology, University of Moratuwa, Sri Lanka for the partial fulfillment of the requirements of the Degree of MSc in Information Technology.

May 2017

Declaration

I declare that this thesis is my own work and has not been submitted in any form for another Masters, Degree or diploma at any university or other institution of tertiary education. Information derived from the published or unpublished work of others has been acknowledged in the text and a list of references is given.

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UOM Verified Signature

Dedication

This dissertation is dedicated to my beloved parents, siblings who gave me endless courage and support to achieve my task and goal in completing the research project.

Acknowledgement

My heartiest thanks go to my supervisor Mr. B.H Sudantha for the guidance, assistance, encouragement, valuable advices on improving the research and providing this opportunity carry out this research project.

I am especially grateful to the lecturers & staff of the Faculty of Information Technology, University of Moratuwa, who lectured and assisted me in various ways during my course of studies and especially during the preparation of this dissertation and project developments.

Colleagues of my batch supported me in various ways during the preparation of this document and in the application development stage. I would like to give my heart full gratitude to them.

I would like to thank my family & friends for their support and encouragement given to me throughout the entire period of this M.Sc.

Last but not least, a sincere thank goes to MAS Holdings Project Darwin Team and MAS Holdings to provide all the development privilege, Box and Authorization to implemented niche SAP solution.

Abstract

In Garments Industry, Tracking the fabric cutting Process is a key requirement in any manufacturing discipline. When the production process is more human oriented, tracking process becomes more difficult compare to an automated process.

Due to the inefficient and decentralized nature of requirements sharing and communication methods used for calculating fabric cutting ratio and planning process of the garment manufacturing industries, a number of issues such as long lead times, high fabric wastage due to incorrect ratio planning, etc have negatively affected high cost and employee relations in the industry.

The project provides SAP R/3 based solution to solving these issues by proposing both a business as well as an IT solution. The deductive approach which to research is used to carry out a comprehensive research that works to identified the factors influence incorrect ratio planning to increase efficiency, reliability & accuracy through the centralized system. These factors are then taken as variables to formulate hypotheses of the study. A comprehensive industrial survey was carried out to gather further details on the subject matter thus the results of it were considered whilst proving or disapproving the hypotheses. The most influential factors identified through the research were then used to design the business solution. Furthermore, various issues, perspectives and theories that were identified through the research were used to model, design and eventually develop the IT solution.

These solutions is provided an all-round solution; both strategically and systematically were highly rated by the evaluators of the project.

Keywords: SAP R/3 , SAP, Lay Planning, Marker Creation, CAD System, Fabric Cutting.

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1. Introduction

1.1. Prolegomena

Tracking the fabric cutting Process is a key requirement in any manufacturing discipline. When the production process is more human oriented, tracking process becomes more difficult compare to an automated process.

Due to the inefficient and decentralized nature of requirements sharing and communication methods used for calculating fabric cutting ratio and planning process of the garment manufacturing industries, a number of issues such as long lead times, high fabric wastage due to incorrect ratio planning, etc have negatively affected high cost and employee relations in the industry.

The project looks at solving these issues by proposing both a business as well as an IT solution. The deductive approach which to research is used to carry out a comprehensive research that works to identify the factors influence incorrect ratio planning to increase efficiency, reliability & accuracy through the centralized system. These factors are then taken as variables to formulate hypotheses of the study. A comprehensive industrial survey was carried out to gather further details on the subject matter thus the results of it were considered whilst proving or disapproving the hypotheses. The most influential factors identified through the research were then used to design the business solution. Furthermore, various issues, perspectives and theories that were identified through the research were used to model, design and eventually develop the IT solution.

Design conceptual framework, which aims at increasing employee satisfaction and deduct overall cost by focusing on managing cost of fabric through the proposed system. On the other hand, the IT solution aims at lay planning to optimize ratio calculation through a centralized SAP system.

These solutions strive to provide an all-round solution; both strategically and systematically were highly rated by the evaluators of the project.

1.2. Background & Motivation

MAS Holdings is the largest apparel and textile manufacture in Sri Lanka and the largest exporter out of this region. They have produced 1000 pieces of high-quality niche-market in apparel. In MAS holdings there is number of diversify business units in several industrial places. Core process of this business industry is manufacturing apparel. They use SAP system for integrate all main business activities in all diversify business units. [1]

The deductive approach to research is used to carry out a comprehensive research that works to identify the factors of fabric cutting process and ordering process in all diversify business plants, which helps provide better solution of this problem. Currently MAS holding company is using a total manual process to manipulate fabric cutting ratios and based on the experience, employee is ordering fabric form vendors for customer requested order. [2] A number of problems such as long lead times due to manual process, slow response rates form other departments, high fabric wastage lead by inaccurate ratio calculation, not interconnected with fabric cutting process, inaccurate stock data, and paper based ratio calculation, no tracking system to compare with past data to compare same material with fabric, lack of decision taking facilities regarding fabric consumption and negatively affected with wastage and cost of fabric ordering process and employee satisfaction in the industry. [3]

The project enables for solving these issues by proposing both a business as well as an IT solution. Business solution is directly provide solution for day to day fabric cutting process activities efficiently and effectively, deducts overall cost through the minimizing fabric requirement and increased employee satisfaction. Proposed SAP solution is used high technology to calculating cutting ratio automatically and integrated with other programs to streamline and optimized business process. It's provided all-rounded solution to avoid above problems.

1.3. Problem Statement

Manual paper and excel based process forced to inaccurate cutting ratio plan and which leads to overall cost of fabric in purchasing and cutting through the increasing wastage.

1.4. Proposed Solution

SAP ERP Lay Planning Management Workbench for MAS Holdings
Full implementation for SAP Apparel and Footwear Manufacturing Plants

These solutions strive to provide an all-round solution, both strategically and systematically to streamline and optimized their fabric cutting process and deduct the overall cost in fabric purchasing.

1.5. Aim and Objectives.

- Identify and rectify existing issues related to ratio calculating for fabric cutting process through comprehensive research and the project looks at solving these issues by proposing both a business as well as an IT solution.
- Proposed solution should be integrated with other existing systems. (CAD system / Docket creation program / Marker history report & etc.)
- Different level authorization to optimized ratio creation process.
- Automated ratio calculation and inline ratio changing capability.
- Mobile Based manager's approval process based on the QR Code and connection integrated thorough the secure web services and RFC connection to integrate SAP and mobile platform.
- Testing and evolution to verify MAS plants requirements are available in proposed system.

1.6. SAP R/3 (AFS) Based Ratio Planning workbench - Solution

Presently MAS holding company is spending a total manual process to manipulate fabric cutting ratios and based on the experience, employee is ordering fabric form vendors for customer requested order.

The project enables for solving these issues by proposing both a business as well as an IT solution. Business solution is directly provide solution for day to day fabric cutting process activities efficiently and effectively, deducts overall cost through the minimizing fabric requirement and increased employee satisfaction by using SAP R/3 AFS ERP system.

Project strives to provide all-rounded solution of business organization (MAS holdings) to manipulating fabric cutting functions effectively and efficiently. MAS as a parent company, there are number of diversify business units in one industry place and interconnected through the SAP system, integrate all business units, provide centralized system to creating and optimized fabric cutting efficiency. Design conceptual framework, which aims at increasing employee satisfaction and deduct overall cost of ordering fabric requirement for take decision for higher management through the total process automation system.

1.7. Structure of Thesis

Chapter 1: Introduction chapter, brief description about production confirmation and its current issues and the solutions proposed are briefly outlined here

Chapter 2: A detailed explanation about problem domain and current system will be covered with in this chapter. A comparison about available solutions also included

Chapter 3: This Technology review chapter covers available technologies and tools that are considered for a development in this nature.

Chapter 4: My approach chapter is about the technologies and methodologies adapted to this system. It will give some detailed explanation about the selected technologies and methodologies I'm going to using in this development.

Chapter 5: This chapter is covering up the analysis and design stage of the development. Starting from the current system study it will provides all the necessary artifacts up to GUI, DATABASE and class designed diagrams.

Chapter 6: Implementation information is included in this chapter. I will be discussing most of the critical and vital implementation methods.

Chapter 7: This evaluation chapter will cover software evaluation methods. With regard to the development it will discuss the evaluation methods and test cases for the evaluation.

Chapter 8: This chapter is for the conclusion and further enhancements to the system. There I will discuss the success of this development and the capabilities of further enhancements.

1.8. Summary

This chapter described the overall description of the research and introduced the research problem and the solution. Next chapter is the literature review which will discuss the work of other researchers on the same domain. It will provide full detailed information about background information of the project based on a literature survey.

Chapter 2

2. Development and Challenges in ratio planning for optimize the cutting efficiency.

2.1. Introduction

Chapter 1 gave a comprehensive description of the overall project described in this thesis. This chapter provides a critical review of the literature in relation to developments and challenges in apparel manufacturing fabric cutting Ratio planning. For this purpose the review of the past researches, software's and articles have been presented under three major sections. Namely, early developments, modern trends and future challenges. At the end, this chapter defines the research problem as the inadequate use of combination of two or more methodologies (techniques) in order to accomplish higher rate of accurate recognition and lack of research works on identification of computer program syntax. In order for achieve higher accuracy rate blend of ratio planning and increase the cutting efficiency in SAP R/3 system without using any 3rd party software's.

2.2. Study the productivity and Financial Efficiency of Textile Industry

There has been much researches related to the apparel manufacturing. This is a fundamental re-examination of how, when and why materials are used. This measure shows how effectively material is used through the system. Any material left in the fabric store is also a waste as it will be disposed of at a much cheaper rate. This is not a very common metrics in garment industry but has been extensively used in textile industry [4].

Mausmi Ambastha has been introduced the "six metrics to track your factory Cutting today". The cutting is considered to be the most important operation in apparel manufacturing because firstly, it handles the costliest material resource – the fabric. Secondly, the spreading and cutting process is irreversible; the concept of repair or alteration does not work here. Further, and most importantly, due to over-emphasis on measuring sewing department performance, there is a sheer neglect of measuring the spreading, cutting and planning performance. This results in building up inefficiencies, leading to erosion of cost advantages [5].

- Material Productivity.

- Marker Efficiency.
- Marked Consumption.
- Achieved Consumption.
- Fabric Utilization
- Cut order plan.

2.3. MAS Holdings.

2.3.1. Overview of MAS Holdings

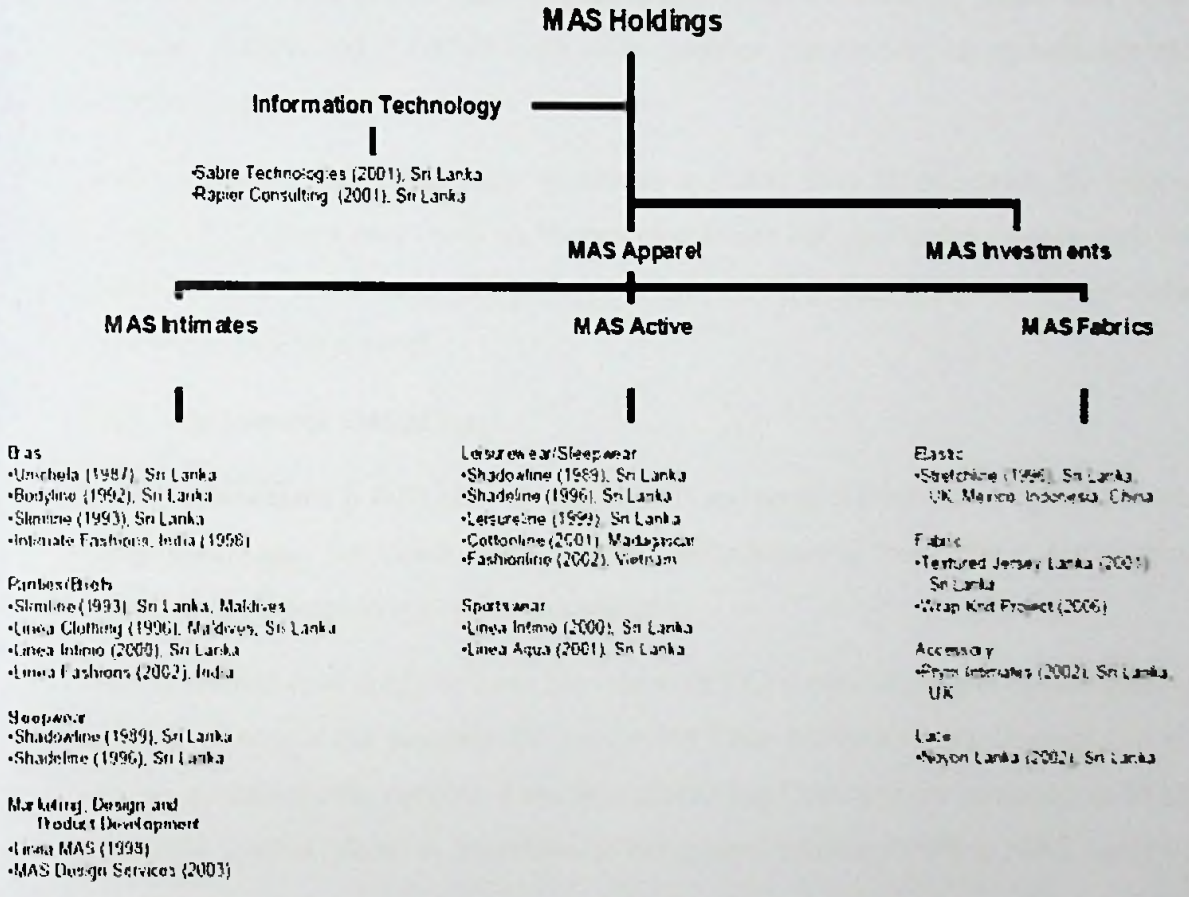


Figure 1:MAS holdings organizational structure

MAS Fabrics Cluster, an end to end supply chain for apparel manufacturing in intimate and active wear is a strategic and unifying component of MAS. Most apparel design and manufacturing houses the world over are required to go beyond the borders of their organisation to source their raw materials. This is where MAS is unique; with its fabric division, MAS has the ability to offer its clientele a completely integrated supply chain from design to delivery.

The Fabrics Cluster embodies a spectrum of manufacturing facilities ranging from fabric and fabric printing to an array of trims including elastic, lace, hook and eye tape and other accessories and embellishments such as bows and motifs. Noyon Lanka is the only knitted lace manufacturer in South Asia producing multiple forms of lace; Trischel is a vertically integrated circular and warp knit fabric facility which is again the only one of its kind in South Asia; the Stretchline Group designs and produces narrow performance fabrics including elastics for a wide range of apparel; Textprint Lanka is a fully integrated fabric printing operation with the ability to print on both cotton and synthetic fabrics making it the only one of its kind in Sri Lanka and Prym Intimates designs and manufactures a wide range of accessories and embellishments for intimate apparel.

With its manufacturing and sales operations spanning over 10 countries, the Fabric Cluster of MAS not only feeds its internal operations but also works closely with its global clientele to deliver a holistic supply chain solution from design to manufacture for a wide range of apparel.

2.3.2. Overview of MAS Active.

MAS Active cluster is fully allocated to NIKE brand apparel manufacturing. It has won many certificates for NIKE brand apparel manufacturing from NIKE for quality standards in all areas in apparel manufacturing.

With the initiative of applying Lean Manufacturing Concepts to apparel manufacturing in MAS Active is the pioneers for implement Lean Manufacturing Concepts to its apparel manufacturing process. Lean Manufacturing Concepts are renamed as MAS Operating System (MOS) in adaptation to the apparel manufacturing in MAS Active.

SAP (AFS) R/3 is implemented as the ERP in the MAS Active Pvt Ltd and it's handling the full operational cycle within the organization. Starting from the order placement, warehouse, manufacturing, billing, finance and delivering is handling from the SAP. All the manufacturing plants are also operates with the help of SAP.

2.3.3. Overview of Active Fabric cutting process.

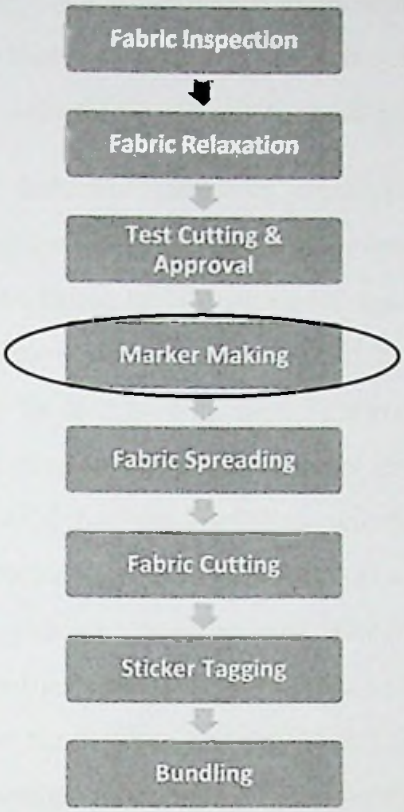


Figure 2: Fabric Cutting Process

Fabric Inspection: When the fabrics are received from the dyeing and finishing section, it needs to be checked, because, faulty fabrics can be supplied from dyeing and finishing. But the cutting section has to check it. Otherwise the end products will be faulty. For this, the fabric is being inspected by the quality inspector of the cutting section. They check the fabric fully and find out the faults. Then mark it so that, these faulty portion of the fabric can be rejected during spreading and cutting. Then the fabric is being stored for relaxation.

Fabric Relaxation: When the fabric comes from the dyeing and finishing, the fabric remains a slightly hot. In dryer, stented and compactor heat is applied on fabric. So moisture is removed from the fabric and it is not in actual condition. But if we keep the fabric in normal temperature and pressure for a certain time, the fabric absorbs moisture from the atmosphere and regains its original nature. This process is called fabric relaxation.

Test Cutting & Approval: After testing the fabric, if it is seemed that, the fabric quality is ok, and then test cutting is done. Here a little amount of fabric is cut and sewed in sewing section. Then the garments are compared with the approved sample. Sewing allowance and other measurements are also observed. If everything is ok, then the approval is given and the fabric is ready for bulk production.

Marker Making: For industrial garments preparation, marker making is a very important chapter for highest usage of fabric and for lowest wastage of fabric. In Divine Textiles Limited there is a strong team working for marker making in cutting section of each floor. This is a process which is performed to draw the pattern pieces on the fabric before cutting. This may be done by drawing the pattern pieces on the fabric directly or by drawing the pattern pieces on a thin marker paper and then placement the paper onto the fabric lay. So, we can define the marker as bellow. Marker is a thin paper which contains all necessary pattern pieces for all sizes for a particular style of garments in such a way that, fabric wastage would be least. The representation or drawing of the arrangement of identified garment pattern relevant to the cutting of a batch material. The marker is placed on the material and provides guideline for cutting. Marker may be on fabric or held in computer data files. Marker width is equal to the minimum fabric width and its length depends on the no of pattern sizes that will be drawn.

Methods of Marker Making: There are two methods of marker making:

- Manual method – Manually calculated ratio on paper.
- Computerized method – Excel Based system.

FABRIC SPREADING: The appropriate type of spreading surface is determined by the fabric type, spreading equipment, cutting method, cutting equipment, and the firm's quality standards. Spreading requires a flat, smooth surface. If the spreading surface doubles as a cutting surface, it also must be level. Spreading and cutting may be done on the same surface, but automated cutting often requires spreading and cutting to be done in adjacent but separate locations.

FABRIC CUTTING: After completing the fabric spreading then the fabric cutting is started. To cut out pattern pieces of garment components as per exact dimension of the

patterns from a fabric lay is called fabric cutting. The term fabric cutting is only applicable for garments manufacturing technology.

Sticker Tagging: After complete the cutting, the fabric is tagging by the sticker. The sticker tagging is an important part in this section. Due to fabric numbering or batching the sticker is tag on the cutting fabric surface.

Bundling: After cutting the fabric lay and tagging the sticker, all the garments components in stack form is shorted out as per size and color. To avoid mistake in sorting, it is better to use code number on each pattern.

2.4. MAS Active Current Ratio (Marker / Lay) Planning.

Currently MAS holding company is using a total manual process to manipulate fabric cutting ratios and based on the experience, employee is ordering fabric form vendors for customer requested order. Based on the pre defended excel format, which are used to calculate ratio planning.

- **Enter Order Details**

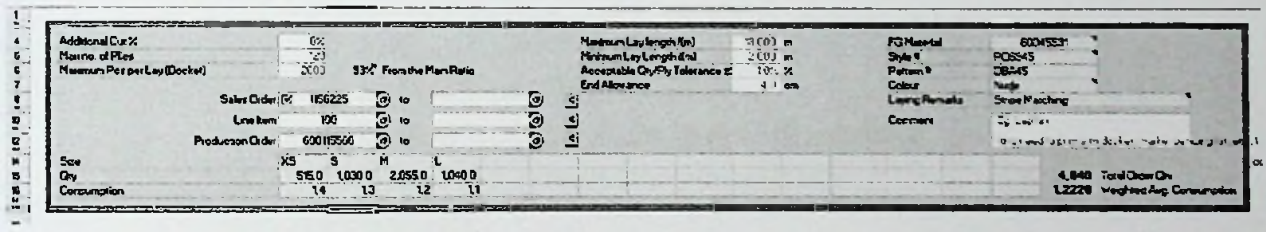


Figure 3: Order Details

- **Size Selection**

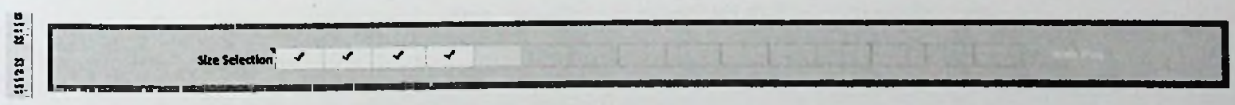


Figure 4 : Size Selection

- **Main Ratio Calculation**

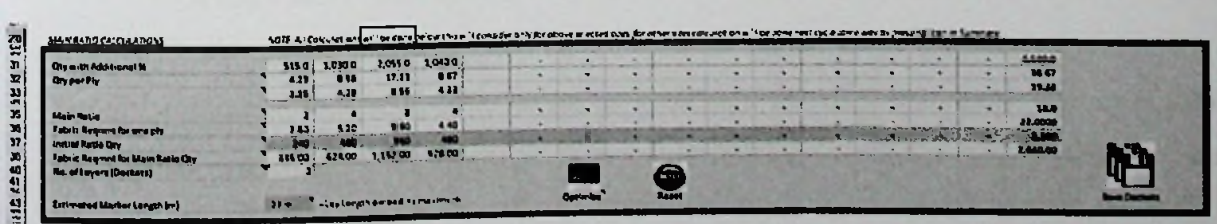


Figure 5:Main Ratio Calculation

- **Balance Ratio Calculation**

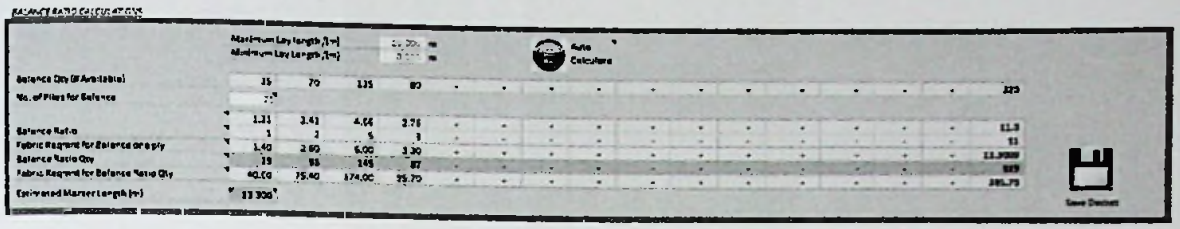


Figure 6: Balance Ratio Calculation

- **Ratio Summary.**

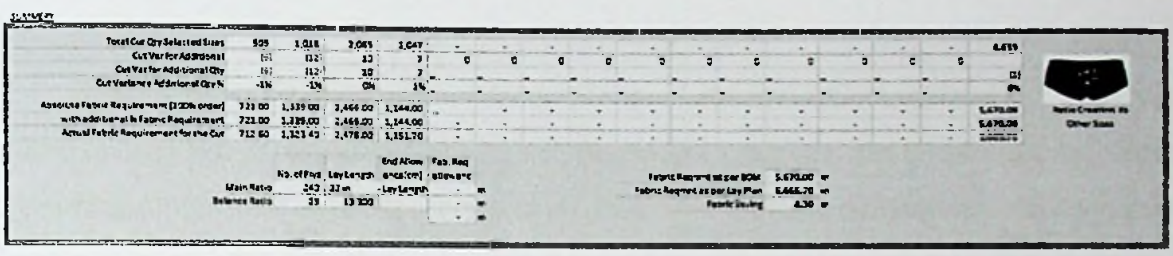


Figure 7: Ratio Summary

2.5. Issue with Current excel based arrangement.

A number of problems such as long lead times due to manual process,

- Slow response rates form other departments.
- High fabric wastage lead by inaccurate ratio calculation.
- Not interconnected with fabric cutting process.
- Inaccurate stock data.
- Paper based ratio calculation.
- No tracking system to compare with past data to compare same material with fabric.
- lack of decision taking facilities regarding fabric consumption
- Negatively affected with wastage and cost of fabric ordering process
- Employee satisfaction in the industry

2.6. Survey of SAP R/3 Based Solution.

Past three years' time period, Project Darwin brings all MAS apparel manufacturing units into a single harmonized SAP AFS instance. Objective of the single system is to deploy a solution that will drive common standards for data structures, common data definitions, common system process & report definition standards held together by an overall governance structure.

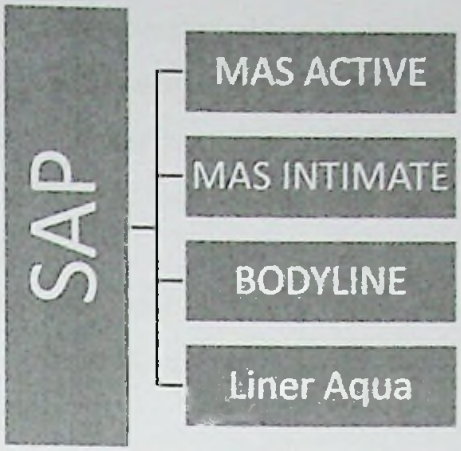


Figure 8:SAP implementation for SBU level

Established single harmonized SAP AFS system, the deductive approach to research is used to carry out a comprehensive research that works to identify the factors of fabric ratio planning process and ordering process in all diversify business plants, which helps provide better solution of this problem.

2.7. Available 3rd party software to capture.

This comprehensive research and software for SAP ERP system. SAP not provided with ratio planning program because it is far unstructured process and totally depend on the business process. There are many third party software's available in market.

2.7.1. intelloCut

intelloCut is an enterprise material management system for the sewn product industry. It saves direct raw material, effort and time at multiple stages of production. intelloCut software is developed by Threadsol Softwares Pvt. Ltd. On an average intelloCut has proved to save around 10% of raw material, accruing an incremental growth in net profit by up to $ 10 Million per annum for enterprises [6].

- **Software Features**
  - **Accurate Estimations.**
    - IntelloCut helps to estimate fabric requirement accurately with the help of its advanced algorithms and actual data analysis.
    - Buy fabric exactly what you needed - no more, no less and least wastage.
  - **Cut plan**

- Generates the most suitable and optimized cut plan from millions of possible combinations. In just one click!
- The solution has been specially designed to handle multiple colors, multiple fabrics, large quantities, large number of sizes and quantities with no ratio
- intelloCut provides options to enter preferred markers; make manual changes and reuse historical data from a library of markers

- **Fabric Grouping**
  - Group's similar width, shade and shrinkage in order to ensure high standards of quality and increased profitability.
  - User can choose multiple levels of grouping based on fabric width, shade, shrinkage (length and width) and fabric delivery dates
  - intelloCut also provides specialized grouping for stock fabrics to ensure minimum groups considering first in first out (FIFO) based fabric storage duration.
  - User friendly drag and drop based editing options for manual changes in fabric grouping.
- **Roll Allocation**
  - Allocates fabric rolls in a single click. Analyzes, creates and re-adjusts to ensure minimum end-bits and wastage.
- **Reporting**
  - Gives complete control over factory's practices by getting real time status and complete tracking.

2.8. Problem definition

SAP R/3 ERP system not provided standard program to calculate ratio for sales order / production order and internal order. There few third party software's available and it break connection with SAP Process. Currently MAS Holding plant are using excel based ratio planning. This research proposed new SAP based program to calculate the ratio plan.

2.9. Summary

This chapter contains the detail description about MAS Holdings and current ratio planning and fabric cutting process. In addition to that this chapter covers the issues

with current ratio planning. Finally it discuss the available solutions and there potentials. Next chapter I will discuss about available technologies to solve this problem.

3. Technology review

3.1. Introduction.

Previously we have discussed about the problem domain and previous work and a descriptive literature review has also been conducted. Strengths and weaknesses of the technologies used by other researches are also mentioned. In this chapter, we will be focusing on technologies that we have used for our solution and the justification for the use of each technology. Target is to bring all the available technologies and their potentials in solving the problem.

3.2. SAP R/3 Based Implementation

SAP R/3 is the former name of the enterprise resource planning software produced by the German corporation SAP AG (now SAP SE). It is an enterprise-wide information system designed to coordinate all the resources, information, and activities needed to complete business processes such as order fulfillment, billing, human resource management, and production planning.

The start of the internet age at the end of the 90's was a big challenge for the big players of the enterprise software industry. While trying to grow at a high speed, the companies, SAP included, were racing not to miss the internet train. Businesses had to be internet-enabled, e-business quickly became the buzzword of the decade, and the software companies introduced new concepts, new products.

Today, SAP offers solutions that improve virtually every aspect of business, government, and education. For example, mySAP Business Suite allows employees, customers, and business partners to work together from anywhere, at any time. SAP's customer relationship management, supply chain management, and product life-cycle management solutions help streamline critical business processes. Leading-edge technologies in such areas as technology platforms, enterprise portals, and mobility provide customers with the tools they need to work more efficiently and profitably.

3.3. Technologies of the Lay Planning workbench.

Proposed solution totally based on the SAP R/3 system.

3.3.1. SAP ABAP Programming Language

ABAP is one of the many application-specific fourth-generation languages (4GLs) first developed in the 1980s. It was originally the report language for SAP R/2, a platform that enabled large corporations to build mainframe business applications for materials management and financial and management accounting.

The ABAP language was originally used by developers to develop the SAP R/3 platform. It was also intended to be used by SAP customers to enhance SAP applications, customers can develop custom reports and interfaces with ABAP programming. The language was geared towards more technical customers with programming experience.

ABAP remains as the language for creating programs for the client-server R/3 system, which SAP first released in 1992. As computer hardware evolved through the 1990s, more and more of SAP's applications and systems were written in ABAP. By 2001, all but the most basic functions were written in ABAP. In 1999, SAP released an object-oriented extension to ABAP called ABAP Objects, along with R/3 release 4.6.

ABAP has an abstraction between the business applications, the operating system and database. This ensures that applications do not depend directly upon a specific server or database platform and can easily be ported from one platform to another.

3.3.2. Project Management Life Cycle

The project management process is usually expressed based on a route map via three project management stages. As mentioned before, the project management stages basically describe the detailed work flow by the project manager. They are designed for integration with the project-specific development work. In each phase of a methodology route map, the project management stages are integrated with phase-specific development stages so that each phase represents a complete project.

Therefore, the set of project management stages is called "The project management life cycle''. In the first stage, which is the startup and preparation, it is important to set up a steering committee, the project management team and the most appropriate stakeholders. These are the people who will provide sponsorship, partnership and so that key decisions can be made easier throughout the life of the

project. It is important that this structure is set up in addition to the core team structure and that these people are well aware of their roles and objectives.

Additionally, it is also important that the project manager ensures that all of the core team is trained at the appropriate times during the project. This activity is coordinated through the project life cycle and the development process. These training activities and needs continue during the project.

3.3.3. SAP ABAP Data Dictionary

Data Dictionary is a central source of information for the data in an information management system. Its main function is to support the creation and management of data definitions.

The ABAP Dictionary supports the definition of user-defined types (data elements, structures and table types). You can create the corresponding objects (tables or views) in the underlying relational database using these data definitions. The ABAP Dictionary describes the logical structure of the objects used in application development and shows how they are mapped to the underlying relational database in tables or views.

3.3.4. SAP ABAP Dictionary allow to create

- **Tables**
  - Tables are defined in the ABAP Dictionary independently of the database. From this table definition follows the creation of a table with the same structure in the underlying database.
- **Views**
  - Views are logical views of more than one table. The structure of the view is defined in the ABAP Dictionary. A view of the database can then be created from this structure.
- **Types**
  - The structure of a type can be defined globally in ABAP programs. Changes to a type automatically take effect in all the programs using the type.
- **Lock objects**
  - These objects are used to synchronize access to the same data by more than one user. Function modules that can be used in application programs are generated from the definition of a lock object in the ABAP Dictionary.

- **Domains**
  - Different fields having the same technical type can be combined in domains. A domain defines the value range of all table fields and structure components that refer to this domain.

3.4. SAP ABAP Function modules

Function modules are procedures that are defined in special ABAP programs only, so-called function groups, but can be called from all ABAP programs. Function groups act as containers for function modules that logically belong together. You create function groups and function modules in the ABAP Workbench using the Function Builder.

Function modules allow you to encapsulate and reuse global functions in the SAP System. They are managed in a central function library. The SAP System contains several predefined functions modules that can be called from any ABAP program. Function modules also play an important role during updating and in interaction between different SAP systems, or between SAP systems and remote systems through remote communications.

3.5. Transport Management System

You can use the Transport Management System to organize, carry out and monitor your transports. You no longer need to execute tp commands at the operating system level. You can start and monitor all imports from every system in the transport domain. The TMS uses the RFC connections that were created automatically when the transport domain was configured to display all information on the requests that are waiting for import. SAP Transport Manager helps to transport Purposed lay planning implementation to each clients.

3.6. Hardware Requirements

- Working Internet connection to access SAP server

3.7. SAP GUI Installation Supported Operating Systems:

- Windows Vista
- Windows 7
- Windows 8

- Windows 8.1
- Windows 10 supported starting with FEP600
- Windows 2008 Server
- Windows 2008 R2 Server
- Windows 2012 R2 Server

3.8. Summary

Majority of latest technologies are capable of saving lot of time from day to day ratio planning and fabric cutting process. This chapter described on how a collaboration between technology and development tasks to deliver a solution. Next chapter will discuss on development approach of the proposed solution.

Chapter 4

4. Novel approach to SAP Based Ratio Planning workbench.

4.1. Introduction.

Having defined the problem in chapter 2, presented technology required for the proposed solution in chapter 3. The approach is described under the hypothesis, input to the system, output of the system, process to convert input to the output overall features of the system and users. SAP based programing solution to improve the ratio planning. There will be two major components in this development as SAP development and non-SAP (Mobile) development respectively. Hypothesis we decided on and the User inputs outputs as well as the process of the system will be the major area which will be focused on.

4.2. Hypothesis.

We can improve efficiency of ratio planning based on the integrated SAP Solution.

These solutions strive to provide an all-round solution, both strategically and systematically to streamline and optimized their fabric cutting process and deduct the overall cost in fabric purchasing.

4.3. Users of the System

- **Managers**
  - Approve the completed ratio plan and enable permission to fabric cutting.
- **CAD System Users**
  - CAD users enable to draw panel based on the created markers.
- **Cutting department Users**
  - Person who created the markers for ratio planning.

4.4. Input to the system.

- **Enter Order Details.**

Based on the following order details, take the order quantity for ratio planning and save the data against to each panel and fabric.

- SAP Sales Order
- Production Order
- Cut Order
- Internal Order
- Wastage & Sample Quantity
  - User need to enter wastage quantity and sample quantity and sum with above total order Quantity.

- **Auto Ratio Parameters**

Main functionality of the proposed solution which is suggested the full automated ratios based on the following parameters.

- **Maximum Lay Length**
  - Maximum Lay length of the Cutting table and lay length of the fabric cutting table.
- **Minimum Lay Length**
  - Minimum Lay length of the fabric.
- **Pieces Per Docket**
  - Number of cutting amount.
- **Max Number of Piles**
  - Number of time for laying the fabric.

- **Manual Ratio Calculation.**

Users have to enter the following ratios details based on their experience.

- Wastage Quantity
- Sample Quantity
- Number of plies
- Number of docket
- Size wise ratio

4.5. Output of the system.

Based on the input values, fetch the relevant data and display the following data accordingly.

- **Order Details**
  - Fetch the details of the order it can be either Sales Order / Production order / internal order. Display the details of Order quantity, material details, Required Size wise quantity and material relevant details of style, color, delivery date, Plant and cutting method.
- **Fabric material Details**
  - Based on the FG Material, Read the SAP Bill of material data. Ratio plan create based on the each panel and fabric.
- **Order Size Details.**
  - Based on the order size wise quantity calculate the wastage and Carton Quantity.
    - wastage Quantity per sizes
    - Carton Quantity
- **Material BOM Consumption Details.**
  - **Number of panel and Fabric details**
- **Ratio Summary details**
  - Total Cut Quantity
  - Fabric Requirement for order.
  - BOM Consumption
  - Fabric Saving
- **Reporting**
- **CAD Export file (.MKX and .CSV flie)**

4.6. Process.

Base on the input value and mainly calculate Ratios for each markers. System process the mainly two functionality.

- Auto ratio Calculation
- Manual Ratio Calculation

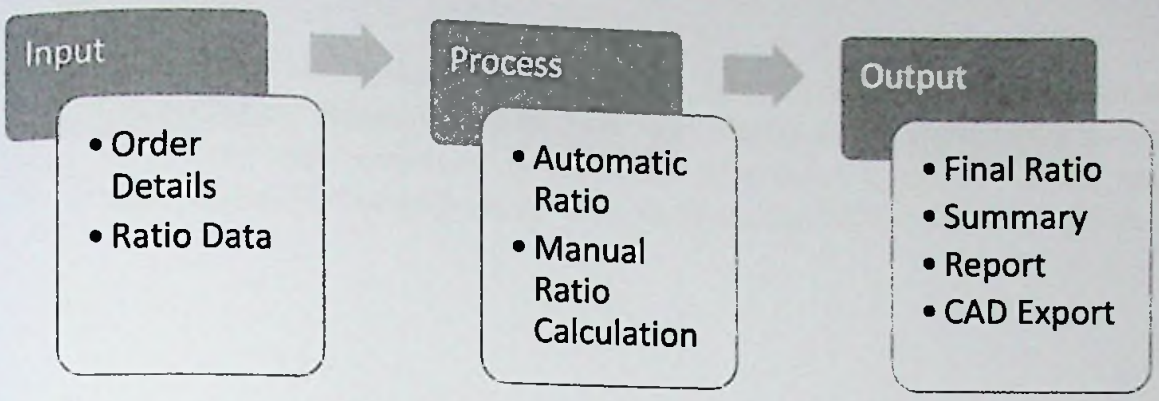


Figure 9: Process of SAP based lay planning

4.7. Features.

- Ratio Plan for
  - Sales Orders (Clubbing multiple sales orders)
  - Production Orders (Clubbing multiple Production Orders)
  - Cut / Swing Order OR Internal Order
- Read the material requirement for each panel and fabric
- Ratio Planning based on grid values (Size wise)
  - Auto Ratio
  - Manual Ratio
  - Optimize ratios
  - Auto Calculation
  - Search Ratio
  - Delete / Add / Rest Copy Ratio details
- Print & Save Marker Data
- Status (Level of Authorizations)
  - Stated
  - Marker Pending
  - Completed – Provide Mobile based approval process for Mangers by using QR code Reader.
  - Reopen
- Summary (Decision making information)

4.8. Summary.

With this we have hypothesis that by using mainly two different system specific ratio Calculation and proposed the SAP Ratio bases marker details and we have discussed the relevant steps/ approaches as well as the components required to get the system implemented. Next chapter will discuss about the design of the proposed Solation.

Chapter 5

5. Design of SAP Ratio (Maker / Lay) Planning System.

5.1. Introduction

Previous chapter gave full picture of the entire solution. This chapter describes the design of the solution presented in the approach. We have design solution SAP ERP Based solution to Ratio planning to optimize the cutting process in apparel manufacturing.

5.2. Business Solution / Conceptual framework

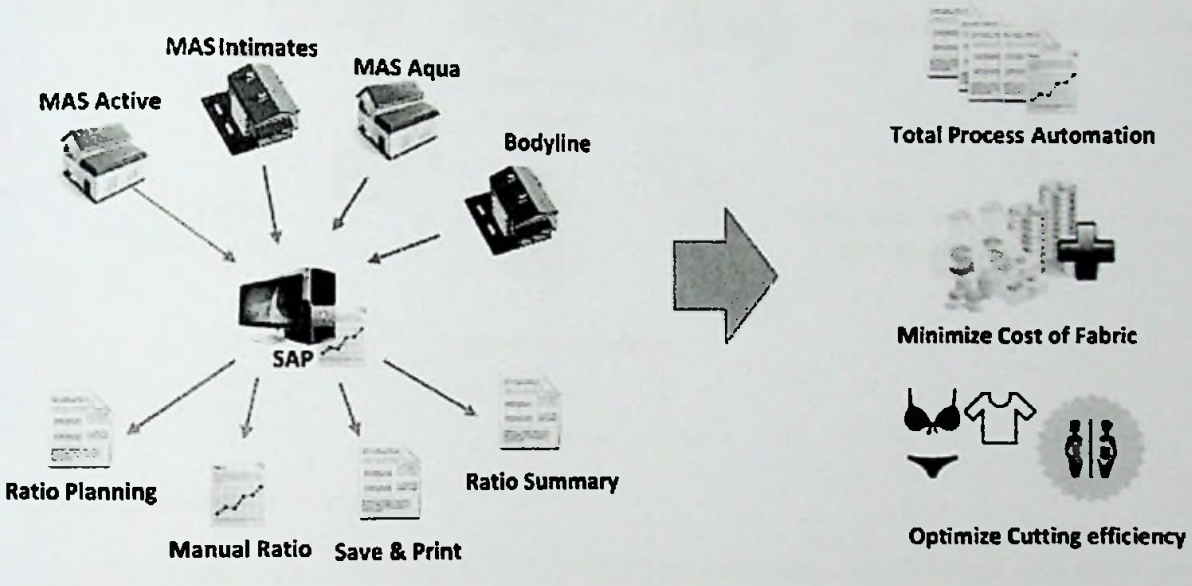


Figure 10: Conceptual framework

Project strives to provide all-rounded solution of business organization (MAS holdings) to manipulating fabric cutting functions effectively and efficiently. In this company, there are number of diversify business units in one industry place and interconnected through the SAP system, integrate all business units, provide centralized system to creating and optimized fabric cutting efficiency. Design conceptual framework, which aims at increasing employee satisfaction and deduct overall cost of ordering fabric requirement for take decision for higher management through the total process automation system.

5.3. Proposed Solution

Proposed SAP solution is used high technology to calculating cutting ratio automatically and integrated with other programs to streamline and optimized business process. It's provided all-rounded solution to avoid above problems.

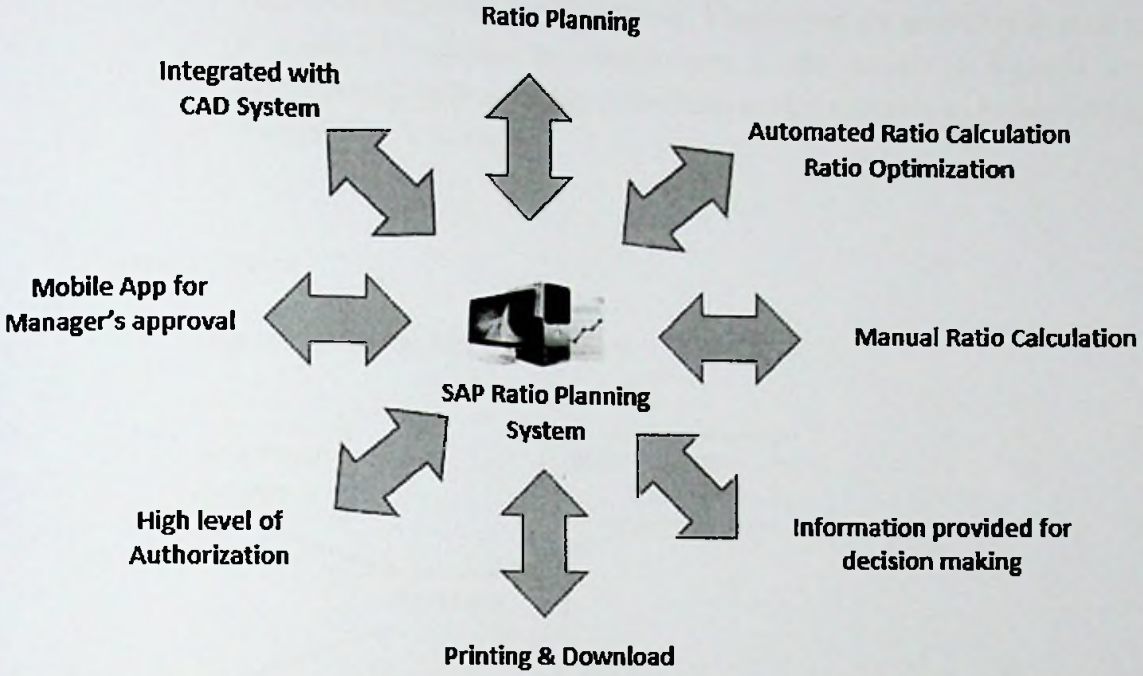


Figure 11: Proposed Solution

5.4. Functional Overview

This system is a completely SAP R/3 ERP based solution. Developing a new program to capture above proposed system with interactive manner. Mobile based solution will improve the effeteness of Managers approval process to fabric cutting process.

5.4.1. Functional Requirements

Main Requirements form MAS Plants end-users.

- Auto Ratio calculation
- Manual Ratio calculation
- Auto optimize the main ratio & Balance Ratio
- Save Functionality to update data base table
- Search Existing ratio for same fabric or Color
- Level of Authorizations
- Levels of system Status
- Reporting
- Summary

5.4.2. Nonfunctional requirement

- System shall provide a method to mitigate the data upload issues to SAP Server.
- System shall maintain a log of Ratio Planning & User details
- Usability: The links are provided for each form. The user is facilitated to view and make entries in the forms. Validations are provided in each field to avoid inconsistent or invalid entry in the databases. Reports screen contains textboxes and drop down lists, so that reports can be produced.
- Availability & Security

5.5. System Design

5.5.1. Flow Diagrams for Proposed system.

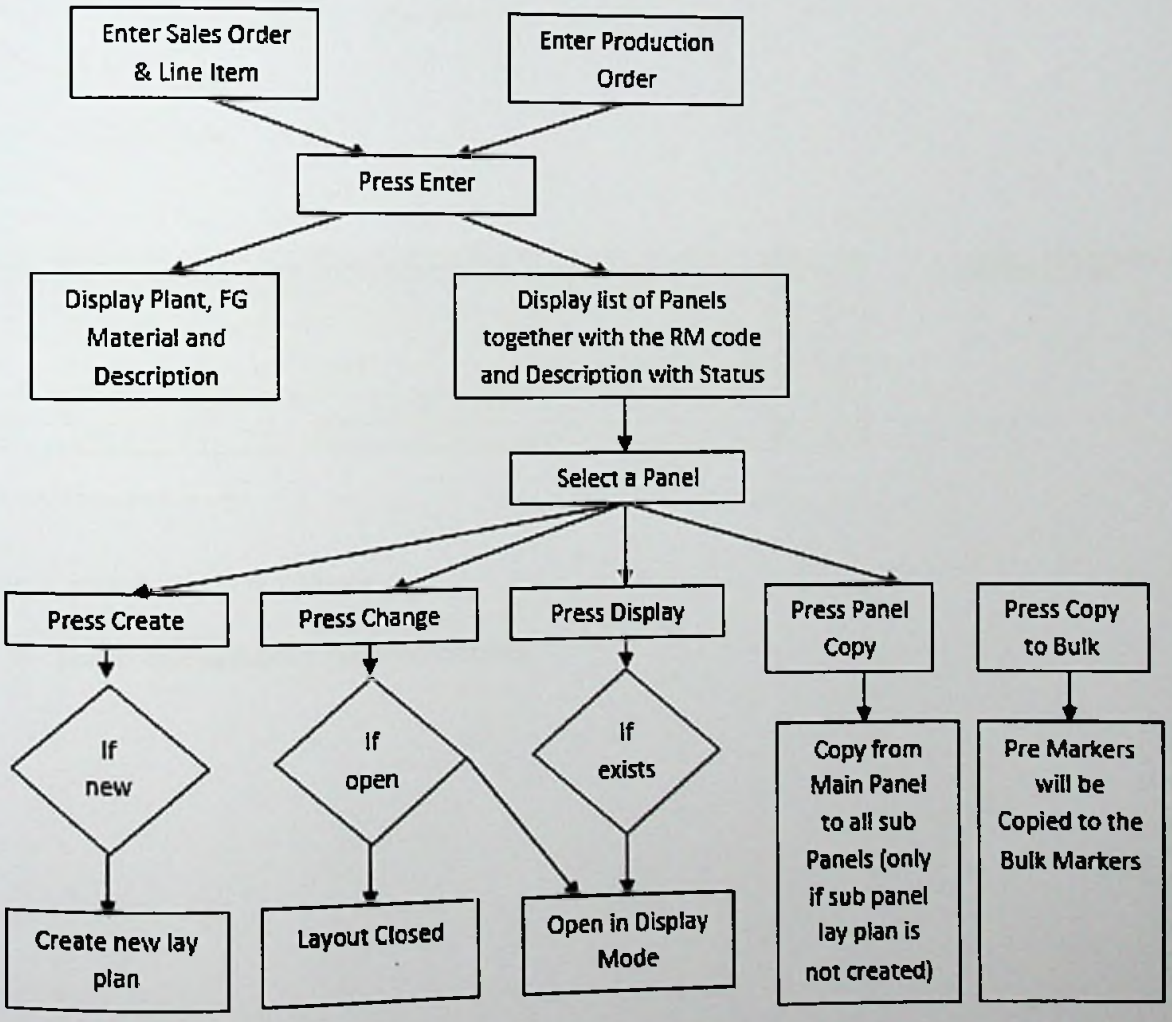


Figure 12: Flow Diagrams

5.6. SAP Module Pool Programming (GUI Designing)

Designing the SAP R/e system to capture the functional Requirement. SAP Specific Programming Patten & designing guide line to implement proposed solution.

- **Table Control is used to get order details**

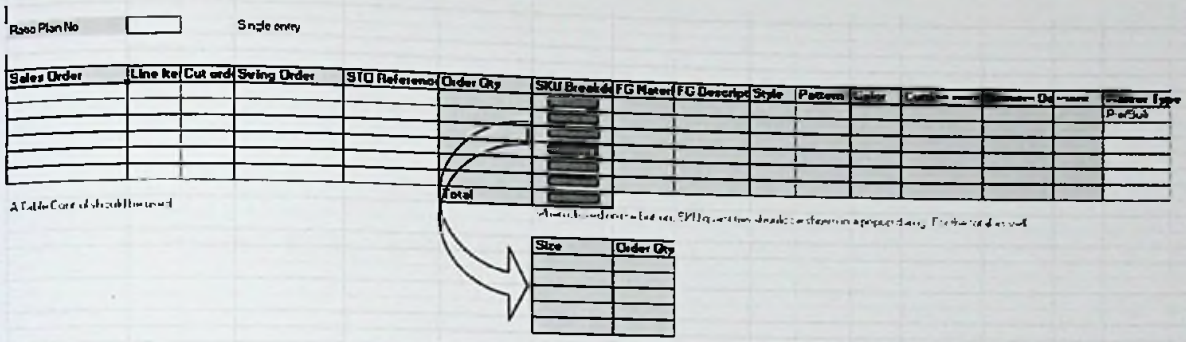


Figure 13: GUI for enter Order details

- **ALV Report.**
- **TAB Screen.**

Select	Panel	RM Material	RM Description	Lab Comments	Status
[X]	CM-40000045	1000000181			
[X]	CP-40000045	1000000182			
[ ]					
[ ]					
[ ]					
[ ]					

Ratio Copy Button

A Table Control should be used.

Figure 14: Display Material BOM details

- **Ratio calculation proposed Screen.**

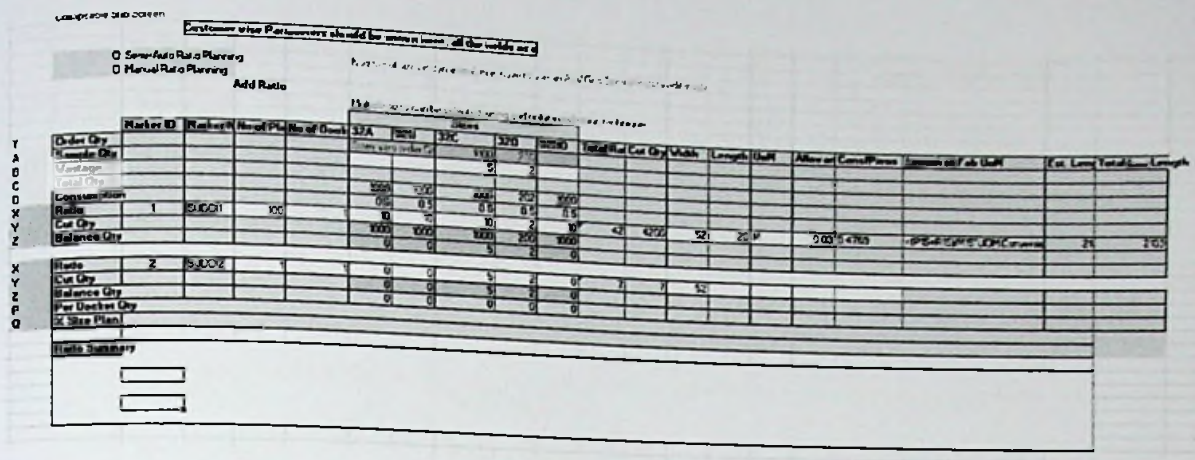


Figure 15:Proposed GUI for Ratio Calculation

5.7. SAP Smart forms Option for print QR code.

5.8. SAP Database Structure.

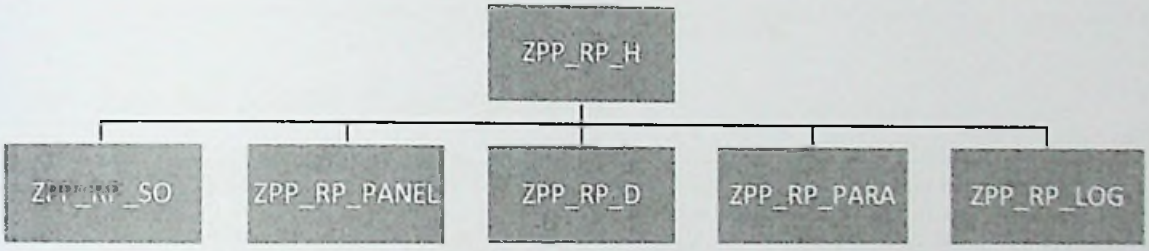


Figure 16:Table Structure

- ZPP_RP_H (Ratio Plan Header Table)

Table 1:Header Table

Field Name	Data Type	Length	Description
RATIO_PLAN_NO	NUMC	12	Ratio Plan No
RP_STATUS	CHAR	1	Ratio Plan Status
LOEKZ	AUFLOEKZ	1	Deletion flag
ZCOMMENT	CHAR	20	Final Status

- **ZPP_RP_SO (Ratio Plan Sales Orders Table)**

Field Name	Data Type	Length	Description

RATIO_PLAN_NO	NUMC	12	Ratio Plan No
VBELN	VBELN	10	Sales Order
POSNR	POSNR	6	Line Item
AUFNR (Cut/Swing)	AUFNR	12	Production Order
ORD_NO	ZORD_NO	10	Internal Order number
MARKER_TYPE	ZMARKER_TYPE	1	Marker Type
WERKS	WERKS_D		
WASTAGE	ZWASTAGE_D		
ORD_QTY	WMENG		
MATNR	MATNR		
ZZCUST_STYLE	ZCUST_STYLE-MARA		
ZDATE	ZMDATE		
UNAME	UNAME		

Table 2:Ratio Plan Sales Orders Table

- **ZPP_RP_PANEL (Ratio Plan Panels)**

Field Name	Data Type	Length	Description
RATIO_PLAN_NO	NUMC	12	Ratio Plan No
FG_MATNR	MATNR	18	FG Material
CUT_MATNR	MATNR	18	Cut Panel Material
FAB_MATNR	MATNR	18	Fabric Material
BUNDLE_QTY	MENGE_D	13/3	Bundle Quantity
FAB_WASTAGE	ZWASTAGE_D		Panel Wastage
PANEL_STATUS	ZPANEL_STATUS	1	Panel Status
COMMENTS	CHAR	200	Panel Ratio Comments
COM_SEQ	ZCOM_SEQ	3	Combine Sequence
DFLT	FLAG	1	Default tics for Combine panel

Table 3:Ratio Plan Panels

- **ZPP_RP_D (Ratio Plan Detail)**

Field Name	Data Type	Length	Description

RATIO_PLAN_NO	NUMC	12	Ratio Plan No
CUT_MATNR	ZCUT_MATNR	18	Cut Panel Material Code
FAB_MATNR	ZFAB_MATNR		Fabric Material
MARKER_ID	ZMARKER_NO	3	Marker ID
J_3ASIZE	J_3ASIZE	J_3ASIZE	Size
ORD_QTY	MENGE_D	13/3	Order Quantity
SAMPLE_QTY	MENGE_D	13/3	Sample Quantity
WASTAGE	MENGE_D	13/3	Wastage
CONSUMPTION	MENGE_D	13/3	Consumption
NO_OF_PLIES	NUMC	4	Number of Plies
NO_DOCKETS	NUMC	4	Number of Dockets
RATIO	NUMC	4	Ratio
WIDTH	ZWIDTH_L	13/3	Width (from CAD System)
LENGTH	ZLENGTH_L	13/3	Length (from CAD System)
UOM	MEINS	3	Unit of Measure (from CAD System)
CONS	ZCONS		Cons/Piecs
TOT_LAY	ZTOT_LAY		Total lay length
FAB_WASTAGE	ZWASTAGE_D		Wastage
CHK_SEW_ORD	ZCHK_SEW_ORD		Ratio For Sewing Order
CHK_ORD_RATIO	ZCHK_ORD_RATIO		Docket Qty as Ratio
CHK_CUT_SEP	ZCHK_CUT_SEP		Cut Separately
FOLDS	ZFOLDS		Number Of Flods
ACT_FAB_REQ	ZACT_FAB_RAQ		Actual fabric Requirment
COMMMENT	ZUSER_COMMENT		Ratio plan Maker Comment

Table 4:Ratio Plan Detail

- **ZPP_RP_LOG (log details about the users)**

Field Name	Data Type	Length	Description

RATIO_PLAN_NO	NUMC	12	Ratio Plan No
CUT_MATNR	MATNR	18	Cut Panel Material
LOG_NO	NUMC	4	Log No
OLD_STATUS	ZPANEL_STATUS	1	Panel Status
NEW_STATUS	ZPANEL_STATUS	1	Panel Status
ZUSER	UNAME		System User
ZDATE	DATUM		System Date

Table 5:log details about the users

- **ZPP_RP_PARA (Ratio Plan – Plant Customer Parameters)**

Field Name	Data Type	Length	Description
WERKS	WERKS_D	4	Plant
KUNNR	KUNNR	10	Customer Code
ADI_CUT_PER	NUMC	3	Addition Cut Percentage
MAX_PLIES	NUMC	4	Maximum number of plies or Genaral Order Quantity
MAX_DKT_PCS	NUMC	5	Maximum number of PCs for a docket
MAX_LAY_LEN	MENGE_D	13/3	Maximum Lay Length
MIN_LAY_LEN	MENGE_D	13/3	Minimum Lay Length
END_ALLOWANCE	MENGE_D	13/3	End Allowance in Meters
WASTAGE_PER	NUMC	3	Wastage Percentage
BAL_MAX_LAY_LEN	MENGE_D		Balance Maximum Lay length
BAL_MIN_LAY_LEN	MENGE_D		Balance Min Lay length
TOLERANCE	ZTOLERANCE		Qty/Ply Tolerance ±%
FAB_WASTAGE	ZWASTAGE_D		Wastage

Table 6:Ratio Plan – Plant Customer Parameters

5.9. Read BOM Details.

	Steps
1	If production order is known, take BOM No (STLNR) and the Alt No (STLAL) from the AFKO table giving the production order number.

2. If production order is not known, take the Alt No as '01' (default value) and get STLNR from MAST table giving FG material (MATNR) and the plant (WERKS).

3. Since the BOM has multiple levels, it needs to be read recursively.

4. Get Base Quantity for each header level from STKO table giving STLNR and STLAL.

5. Get components attached to a header level using below Select Statement.

```
SELECT a~stlkn idnrk
INTO (lv_stlkn, lv_idnrk)
FROM stpo AS a JOIN stas AS b ON a~stlnr EQ b~stlnr AND a~stlkn EQ b~stlkn
WHERE a~stlnr EQ lv_stlnr
  AND b~stlal EQ lv_stlal.
```

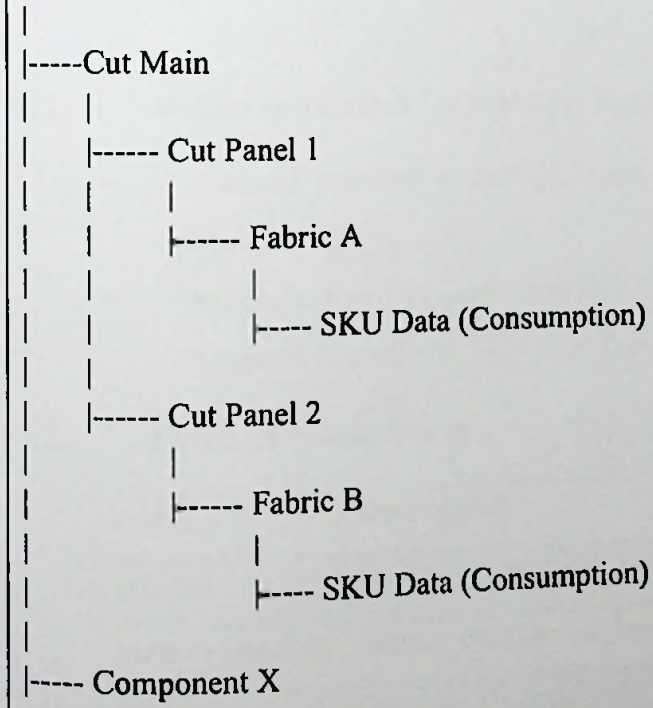
In this IDNRK is the component material code.
Use Material Group (MARA-MATKL) to filter "MAINPANEL" and "CUTPANELS".

6. Get BOM SKU data using below query.

```
SELECT SINGLE menge
INTO lv_menge
FROM j_3abomd
WHERE stlnr      EQ lv_stlnr
  AND j_3akordx EQ lv_j_3asize
  AND stlkn      EQ lv_stlkn
  AND menge      GT 0.
```

In this MENGE is the consumption.

7. Example BOM:



Steps of a sample program:

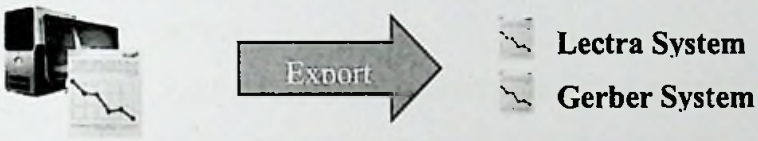
First read the FG material BOM header data.
Read the direct attached components of the FG material. That is Cut Main and Component X in the above example.
Then take each component and read the SKU level data.
Then take each of the component and do the step 2 until all the BOM is traversed.

```
CALL FUNCTION 'MATERIAL_UNIT_CONVERSION'
  EXPORTING
    input    = im_quantity
    kzmeinh  = 'X'
    matnr    = im_matnr
    meinh    = im_from_unit
    meins    = im_to_unit
  IMPORTING
    output   = ex_quantity
  EXCEPTIONS
    OTHERS   = 1.
```

Table 7: Process of reading BOM

5.10. CAD System Download.

System should provide the export maker details to the Fabric cutting machine.



5.11. Mobile application for Manager Approval.

- Android application for QR code reading and communicate with SAP System.
- Secure way to communication with Central Database using RFC Request and Respond through the SAP PI system.

5.12. Levels of system Status

Status	Description
Started	User has commenced the lay plan creation
Marker Pending	Marker data has not been entered
Complete	Lay plan is closed

Reopened	Completed marker has been reopened for revision

Figure 17: list of Ratio Planning Stages

5.13. GUI Designing process in SAP

All the user interfaces are designed in SAP. Therefore the standard SAP GUI design methodology is performed. Following SAP standard GUI design methodology is performed in user interface design. Therefore no need of user training for the user interfaces.

- All the GUI's are designed in SAP
- Font will be SAP standard font type and size for the screen.
- Screen Back Ground will be standard SAP background.
- Text Boxes will be design as per the standard SAP Text boxes.
- Data Grids will be design as per the standard SAP Data Grids.
- All the main screens are numbered as 1000,2000,....etc
- Sub screens are numbered as (1100,1200,....) depend on the main
- screen
- All the screen should contain a Title Bar and "PF-Status"
- Title bar name Format: "TITLE_ScreenNO".
- PF-Status name Format: "STAT_ScreenNO".
- PF-Status configurations.

In the PF-Status the Standard Tool bar should be as follows

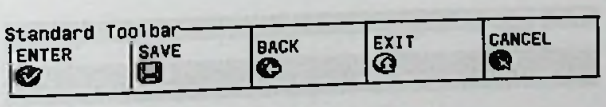


Figure 18:PF – Status Standard

In the PF-Status the Application Tool bar should be as follows:

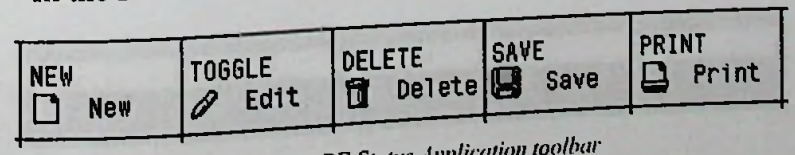


Figure 19:PF-Status Application toolbar

5.14. GUI Screen and Buttons

- **Selection Screen - Group Option**
    - When multiple sales order line items are entered with the same cut panel fabric and with the same SKU data, order quantities need to be clubbed. Ratios need to be created for that clubbed SKU quantities.
    - If entered sales orders do not match above criteria, give and error.
    - Do not allow to enter multiple Production orders or STO numbers.
    - If a given Sales Order is already in a other saved Ratio Plan, program should show and error displaying that Ratio Plan No and should not allow to create another Ratio Plan for that Sales Order.

- **Selection Screen – Ratio Plan No**
    - When Ratio Plan No is entered, program should populate all the data related to the given Ratio Plan No.

- **Panel Selection Screen**
    - Panel details should be shown here for the given selection in the selection screen with the Panel Status.

- **Panel Selection Screen - Complete Button**
    - If all the panel have completed ratio plans, set the Ratio Plan status to Complete

- **Panel Selection Screen - Re-Open Button**
    - Set the Ratio Plan status to Re-open

- **Panel Selection Screen - Status Change Log Button**
    - This should popup a dialog box showing data in the ZPP_RP_LOG table corresponding to the RATIO_PLAN_NO.

- **Panel Selection Screen - Ratio Copy Button**
    - This button is active for the main fabric (CUTMAIN fabric).

- Users can copy the same ratio information for all the panels with the same fabric in that order by pressing this button.

- **Panel Selection Screen - Save Button:**
  - Need to save Ratio Plan Header data, Sales Order data, Panel data and marker ratio data in to respective ZTable created above.
  - RATIO_PLAN_NO should be generated using a Number Range Object ZPP_RP (SNRO).
  - Message should be shown with the created Ratio Plan No.

- **Panel Selection Screen - Delete Lay Plan Button:**
  - Flag Ratio Plan as deleted (LOEKZ = 'X') after checking authorization to delete.

- **Panel Selection Screen - Panel Markers Button (Marker Dropdown)**
  - This will pop up a screen with historical markers (for the same FG + Cut Panel + Fabric) that have the same SKUs and also display the SKU wise ratios as well as the width and length information.

- **Ratio Planning Screen - Update from CAD Button**
  - When user presses this button, it will take the CAD interface data which is in the CAD interface ZTable and populate the marker number, ratios, width, length and UOM.
  - Once these are populated, the program will auto calculate the marker consumptions.
  - If there are no values in the CAD tables, then don't delete the values on the screen.
  - Users have to enter the Marker No first and then press this button to update.

- **Ratio Planning Screen - Ratio Delete Button**
  - Should allow to delete created ratios.

- **Ratio Planning Screen - Ratio Add Button**
  - Next Ratio should be add to the ratio editing grid, depending on the option selected.
  - Two options available (semi-auto & manual). These two logics are explained below.
  - A ratios set is corresponded to a MARKER_ID). Marker ID is sequential number start from 1.

5.15. Summary

This chapter discussed full detailed analysis and design methodology of ratio planning system. Starting with analyzing current system, system analysis's goes up to the proposed systems class and database design. Next chapter will cover the implementation details of the system.

Chapter 6

6. Implementation SAP Ratio Planning System.

6.1. Introduction.

Last chapter is for the analysis and design. It provides all the necessary artifacts for implementation. This chapter will discuss about the implementation methodologies I carry out in implementing the system.

6.2. Overall Solution.

Overall solution has been implemented in SAP System and Android mobile application is implemented to Manager's approval process of accepting final marker cutting process.

Process	Development language
SAP Ratio Planning Program	SAP ABAP
Android Mobile App	Android / JAVA
Data Base Implication	SAP SQL
Interconnection Between SAP and Mobile App	SAP PI Technologies.

Table 8: Implementation Stages

6.3. Implementation of SAP Program.

Implementation of SAP program is the main challenge of this scenario because we have to streamline all MAS SBU's to one harmonize system with their independent requirements. Complete requirements of SAP system divided into main phases to implement separately.

6.3.1. Main Data Fetching criteria

Description	Comment
Order Quantity	If Sales Order, then take the sales order quantity + the wastage percentage If Production Order, then take display the production order quantity

	If STO, then take STO quantity If planned order, then take quantity from Staging production Z table (which has the firmed production quantity)
Sample Quantity	If there is a sales order line item (not contract) that is referring to this sales order line item, then select the values from that sales order and display it. User can manually type this quantity in as well
Marker Number	Marker number can be manually entered by the user. This field should also have a dropdown facility. The dropdown should read the Marker Database and display markers available for the FG Material and RM Code.
Marker number	Manual entry field, or updated by the CAD interface
Number of plies	Manually entered
SKUs	From the sales order/sto/planned order or production order
Ratio	Total of entered values
Cut Quantity	Total column
Width	Manual entry field, or updated by the CAD interface
Length	Manual entry field, or updated by the CAD interface
UOM	Manual entry field, or updated by the CAD interface
Length in UOM	If the fabric UOM is different to the marker UOM, then need to convert it to the fabric UOM UOM conversion to be maintained in a Z table with a maintenance view
Consumption/piece	=Length / total ratio
Estimated length	= Length in Fabric UOM * No of Plies
Qty	= No of plies * ratio value
Balance	= Balance - Qty
Bundle size	Manual entry field. If values exist in PP-E-021-T05 for the hierarchy or the plant, then display those values here

Average Prod	Same as above

Table 9:Main data fetching Criteria

6.3.2. GUI for Enter Order Details & Display Order Details

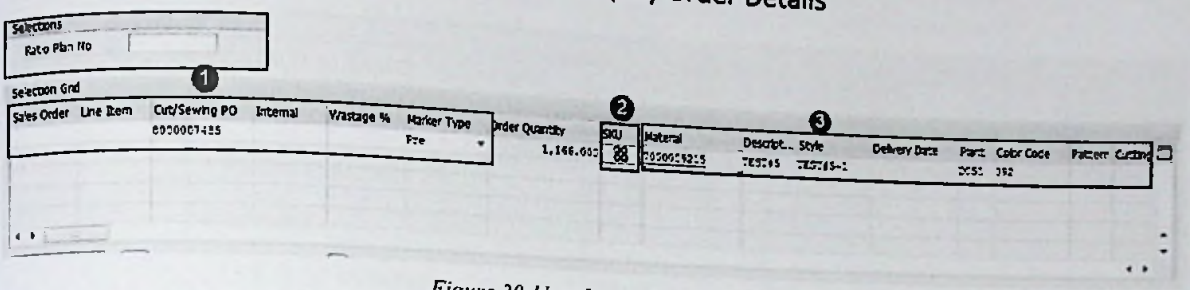


Figure 20:User Input of order details

User needs to enter either (1)

- sales order line item
- Production order
- Internal Order
- Reference (STO/planned order used for staging progress) as a mandatory selection.

Based on the order, need to display following order details in same screen.

- Order Quantity
- Order Material details (Style, Plant, Color, Pattern) (3)
- Order Size wise Break Down with wastage quantity, Carton quantity (2).

6.3.3. Database sources (Tables for data selection).

Based on the order type, fetch above data form following SAP data base table.

Data	Table	Field
Sales Order	VBAP	VBELN
Line Item	VBAP	POSNR
FG Material	VBAP	MATNR
Sales Order Plant	VBAP	WERKS
Production Order	AFPO	AUFNR
Sales Order	AFPO	KDAUF
Line Item	AFPO	KDPOS

FG Material	VBAP/AFPO	MATNR/MATNR
Sales Order Plant	VBAP/AFPO	WERKS/ PWERK
Sales Order SKU Size	VBEP	J_3ASIZE
Sales Order SKU Quantity	VBEP	LMENG
Production Order SKU Data	J_3ABSSI	J_3ABSNR
Production Order SKU Size	J_3ABSSI	J_3ASIZE
Production Order SKU Quantity	J_3ABSSI	MENGE
FG/Fabric Material Description	MAKT	MAKTX
Material Group	MARA	MATKL
Material Type	MARA	MTART
Style	MARA	BISMT
FG Color/Color	MARA	WRKST
Delivery Date	VBAP	J_3ARQDA

Table 10Table for fetch Order Details:

6.3.4. Display Order Size wise data.

Need to display Size wise order break down, wastage & Carton Break down for each sizes.

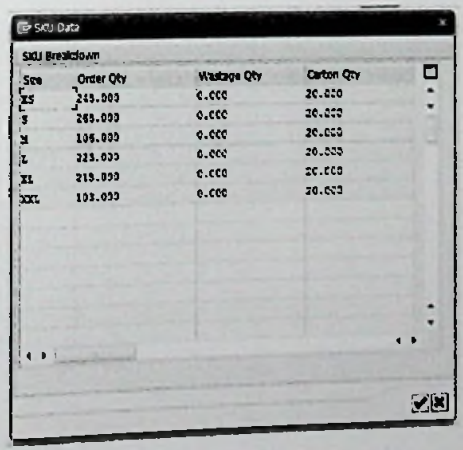


Figure 21:Size wise details

```
LOOP AT gi_sku_all INTO gwa_sku.
  lwa_sku_tem = gwa_sku.
```

```
  tot_qat     = tot_qat + gwa_sku-kwmeng.
  tot_wastg   = tot_wastg + gwa_sku-size_wast.
*     gv_tot_qty = gv_tot_qty + gwa_sku-kwmeng.

  AT END OF j_3asize.
   gwa_sku-kwmeng   = tot_qat.
   gwa_sku-size_wast = tot_wastg.
   gwa_sku-matnr    = lwa_sku_tem-matnr.
   gwa_sku-flag     = abap_true.
   gwa_sku-vbeln    = lwa_sku_tem-vbeln.
   gwa_sku-posnr    = lwa_sku_tem-posnr.
   gwa_sku-aufnr    = lwa_sku_tem-aufnr.

   APPEND gwa_sku TO gi_sku.
  ENDAT.
 ENDLOOP.
```

6.3.5. Display Fabric Material BOM Consumption data

According the order material, extract the attached fabric and panel for particular material and user selection is required to take relevant consumption to proceed ratio planning.

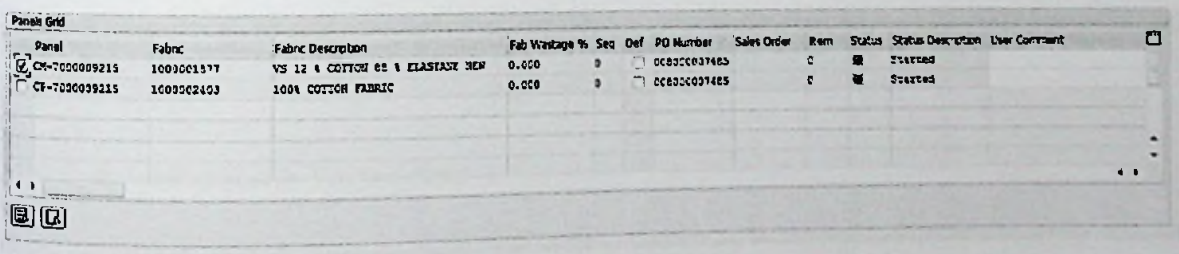


Figure 22: Material BOM Selection

Steps of a reading BOM:

- First read the FG material BOM header data.
- Read the direct attached components of the FG material. That is Cut Main and Component X in the above example.
- Then take each component and read the SKU level data.
- Then take each of the component and do the step 2 until all the BOM is traversed.

```
"Read BOM Detils
CALL FUNCTION 'ZUTIL_BOM_READ'
 EXPORTING
  im_matnr      = lwa_select_main-matnr
  im_werks      = lwa_select_main-werks
  im_size       = 'X'
  im_vbeln      = lwa_select_main-vbeln
  im_posnr      = lwa_select_main-posnr
 IMPORTING
  ex_bom_size   = li_bom_size
  ex_bom_items  = li_bom_items
  ex_bom_category = li_bom_category.
```

6.4. Navigate to Ratio Panel Main Screen (Screen 200)

After panel Selection, user should navigate to main screen of ratio calculation.

6.4.1. Display Header Panel to display

- **Order Details**

In second screen, header view there are three main tabs to display details of order. Based on the panel selection each details displayed in respective tabs.

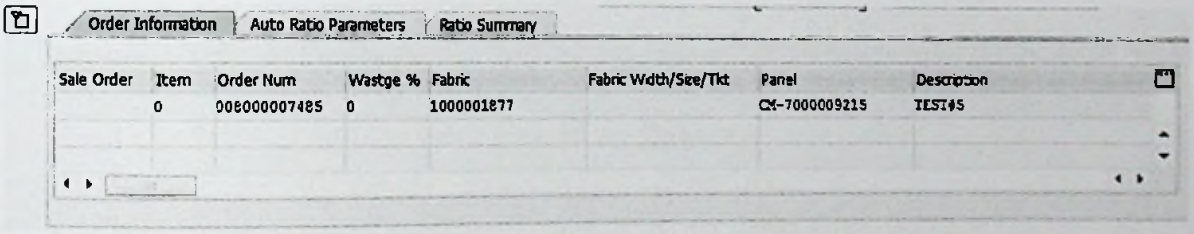


Figure 23:Order Details

- **Auto Ratio Parameters**

Below Parameters, which are used to calculate the Auto ratio functionality. Based on parameter values calculate the Ratio and validate to provide maximum ratio for fabric cutting.

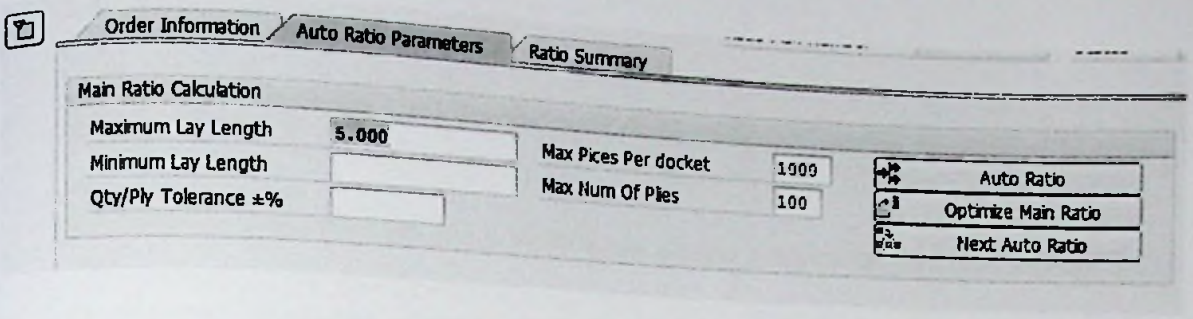


Figure 24:Auto Ratio Parameters

- **Ratio Summary**

Based on the ratio calculation provide the Summary view for decision making for maximize the fabric cutting process. Adjustment of ratio calculation have been done based on the Summary. Provide the overall summary view to accelerate one time marker planning.

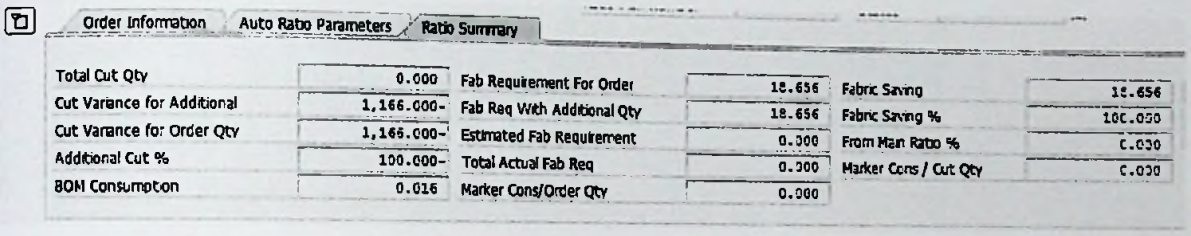


Figure 25:Ratio Summary

Ratio Summary Calculation logic.

- Total Cut Qty = SUM (Cut Qty) from all the iterations.
- Cut Variance for Additional = Total Cut Qty - Order Qty.
- Cut Variance for Order Quantity = Total Cut Qty – (Order Qty - Wastage)
- Additional Cut % = (Cut Variance for Order / Order Qty)%
- Absolute Fabric Requirement = Order Qty X Consumption
- With Additional % Fabric Requirement = (Order Qty + Additional Qty) X Consumption
- Actual Fabric Requirement = Total Cut Qty X Consumption
- Total Number of Plies = Total Number of plies from all the iterations.
- Total End Allowance Length = Total Number of Plies X End Allowance (in Meters)
- Total Fabric Requirement as per BOM = SUM (Absolute Fabric Requirement).
- Total Fabric Requirement for the Ratio Plan = SUM (Actual Fabric Requirement).
- Fabric Saving = Total Fabric Requirement as per BOM - Total Fabric Requirement for the Ratio Plan.

```
LOOP AT gi_sku INTO gwa_sku.
  "Absolute Fabric Requirement = Order Qty X Consumption
  gwa_summmary-abb_fab_req = gwa_summmary-abb_fab_req + ( gwa_sku-kwmeng* gwa_sku-
```

```
consumption ) .

  "Fab Req With Additional Qty
  gwa_summmary-add_fab_req = gwa_summmary-add_fab_req + ( gwa_sku-tot_qty * gwa_sku-
consumption ) .

  "BOM Consumption
  gwa_summmary-bom_cons = gwa_summmary-bom_cons + ( gwa_sku-kwmeng * gwa_sku-consumption ) .

  "Cut Variance for Additional = Total Cut Qty - Order Qty. DONE
  gwa_summmary-cut_var_add = gwa_summmary-tot_cut_qty - gwa_summmary-tot_qty.

  "Cut Variance for Order Quantity = Total Cut Qty - ( Order Qty - Wastage )
  gwa_summmary-cut_var_oqty = gwa_summmary-tot_cut_qty - gv_tot_qty.

  " Additional Cut % = (Cut Variance for Order  / Order Qty)%
   gwa_summmary-add_cut = ( gwa_summmary-cut_var_oqty / gv_tot_qty ) * 100.
  gwa_summmary-fab_saving = gwa_summmary-tot_fab_rat.

*Adding Fab Wastage(Total) % to Total Actual Fabric Requirement
  lv_fab_wastage = ( gv_fab_wstge + 100 ) / 100.
  gwa_summmary-tot_fab_req = gwa_summmary-tot_fab_req * lv_fab_wastage.
 "Marker Consuption = Actual Fabric Req / Total Cut Qty
 IF lv_tot_cut_qty IS NOT INITIAL.
  gwa_summmary-mar_cons = gwa_summmary-tot_fab_req / gwa_summmary-tot_cut_qty.
 ENDIF.
 ENDLOOP.
```

6.4.2. Auto Ratio calculation

This is the main function of proposed system. Ratios should be generate automatically according to the total quantity.

- Auto Ratio Parameters

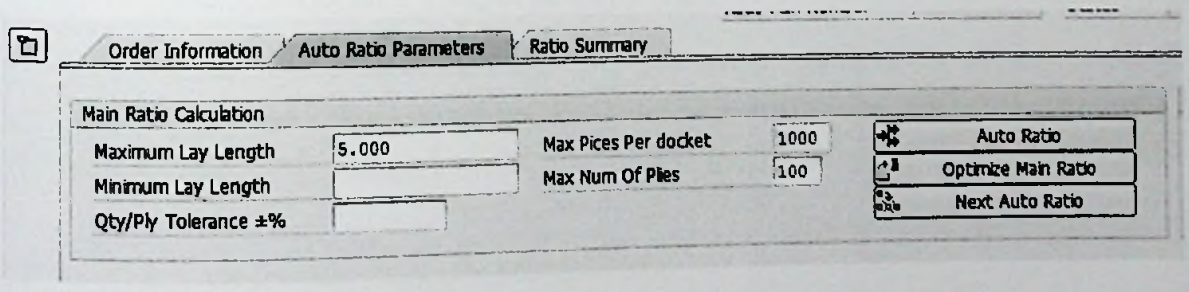


Figure 26:Auto Ratio Parameters

- Calculation logic for Auto Ratio

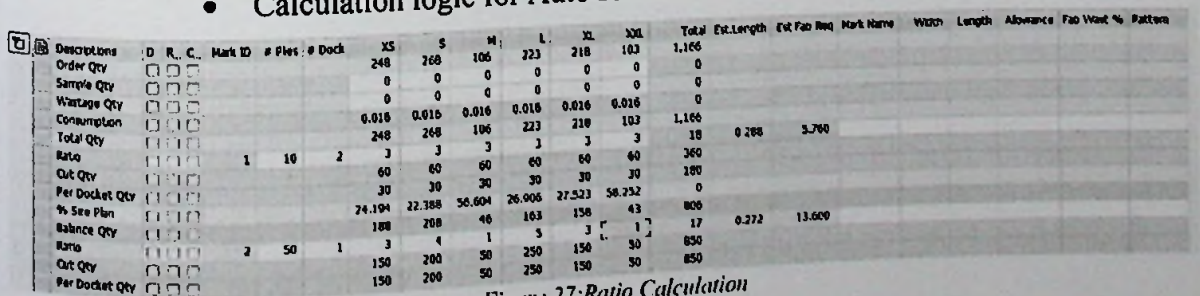


Figure 27:Ratio Calculation

- Accept value for maximum PCs for a docket (or General order qty for customer) (max_pcs_per_docket).
- Number of main ratio dockets = Total Order Quantity / max_pcs_per_docket = no_of_main_dockets
- Round down no_of_main_dockets to the largest integer. (ie 4.59 => 4)
- Accept value for bundle quantity (bundle_qty).
- Number of layers (plies) = no_of_main_dockets X bundle_qty = no_of_plies.
- Main Ratio = Order Quantity / no_of_plies
- Round down Main Ratio to largest integer. (ie. 3.6 => 3)
- Ratios proposed above should be able to manually change from the grid as well.
- Iteration Summary should be displayed after each of those iterations.
- Take the balance to cut quantity from each size to the next iteration.
- Do Until (Estimated Marker Length is less than or equals Maximum Lay Length)
    - Increase the number of plies starting from 1, until the above is reached.
    - Ratio = Balance Quantity / Number of plies
- End Do
- Ratios proposed above should be able manually change from the grid as well.
- All the size balances should be carried forward to the next marker ratio iteration.
- Iteration Summary should be displayed after each of those iterations.

6.4.3. Manual Ratio calculation

User can either use auto ratio function manual ratio functionality according to their preferences

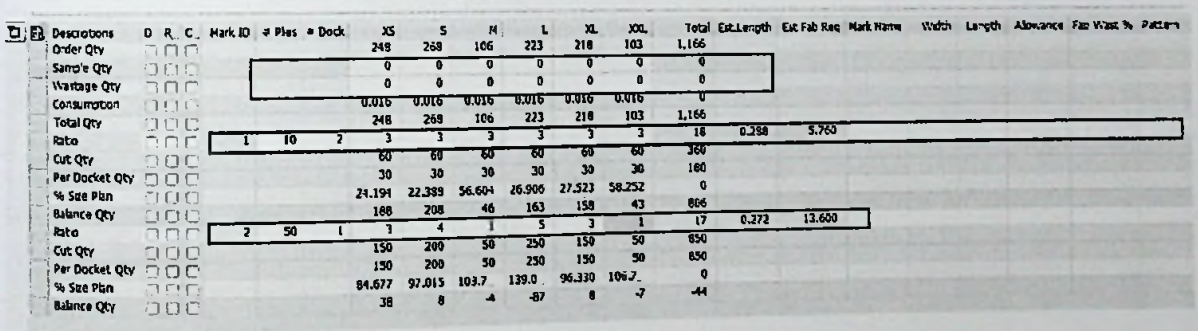


Figure 28:Manual Ratio User Input

- Accept ratio values for selected sizes.
- Accept value for number of plies.
- Accept value for number of dockets.
- Cut Qty = Ratio X Number of Plies X Number of dockets.
- Balance = Order Qty - Cut Qty.
- Iteration Summary should be displayed.
- All the size balances should be carried forward to the next marker ratio iteration.

  This is, balance quantities will be the order quantities in those iterations.

- Iteration Summary should be displayed after each of those iterations.

6.5. Auto optimize the main ratio & Balance Ratio

After auto ratio calculation user will optimize the calculated ratio by increasing docket numbers.

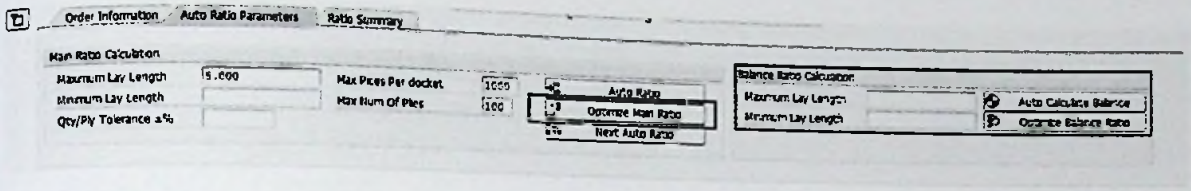


Figure 29:Optimize main ratio

6.6. Save Functionality to update data base table.

- Need to save Ratio Plan Header data, Sales Order data, Panel data and marker ratio data in to respective ZTable created above.
- RATIO_PLAN_NO should be generated using a Number Range Object ZPP_RP (SNRO).
- Message should be shown with the created Ratio Plan No.

6.7. Search Existing ratio for same fabric or Color.

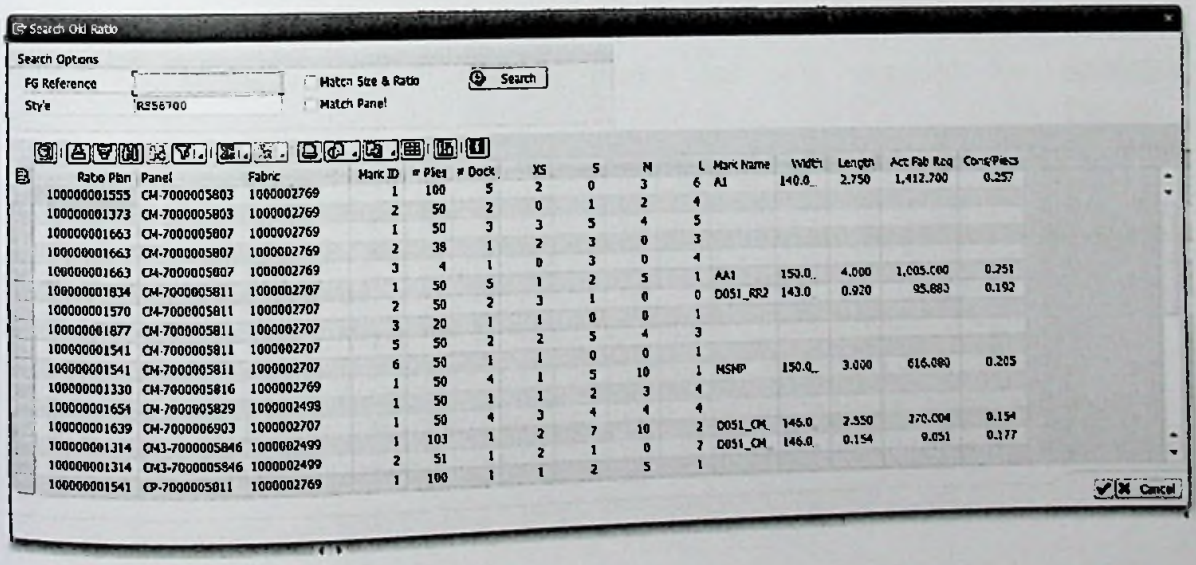


Figure 30:Search Ratio

Need to be able to pick old ratios which have the same sizes as the order SKU breakdown

- Need to search based on FG and RM without color (FG Ref)

- Need to have a confg for select the Plant based.
- Need Display ALV
- Need to copy selected ratio to Lay Plan
- Need to Marker Consumption / Fabric Req

6.8. Level of Authorizations

SAP Authorization object is need for following functions.

- Delete Ratio Plan
- Save & Copy lay Plan
- Send to CAD
- Complete
- Reopen

6.9. Levels of system Status

Introduced Separate buttons for change the system status.

Status	Description
Started	User has commenced the lay plan creation
Marker Pending	Marker data has not been entered
Complete	Lay plan is closed
Reopened	Completed marker has been reopened for revision

Complete Button

When user presses the **complete button:**

- If status is 'started', then check if all the marker#, length and width data has been entered.
  - If entered then change the status to 'Complete'.
  - If not entered it will be changed to 'Marker Pending'.
- If status is **'Marker Pending'** check if all the marker#, length and width data has been entered.
  - If entered then change the status to 'Complete'.
  - If not entered keep it as 'Marker Pending'.

6.10. Export Ratio Plan to CAD System.

This is the import part of the program. Calculated ratios passing to the CAD upload to fabric cutting process. Project strives to provide all-rounded solution of business organization through the automated solution.

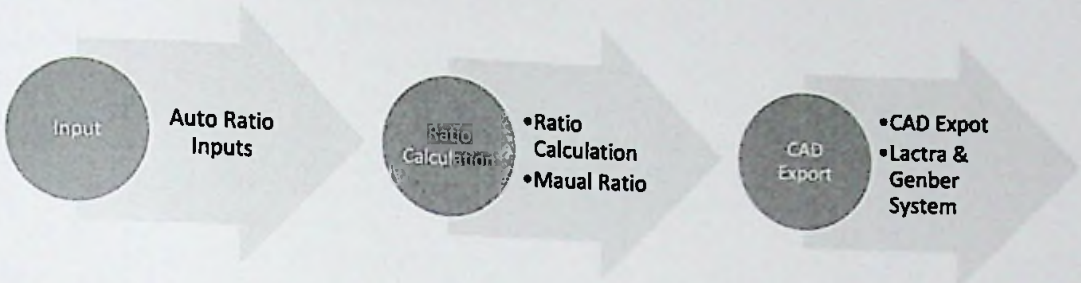


Figure 31:Ratio Planning Process

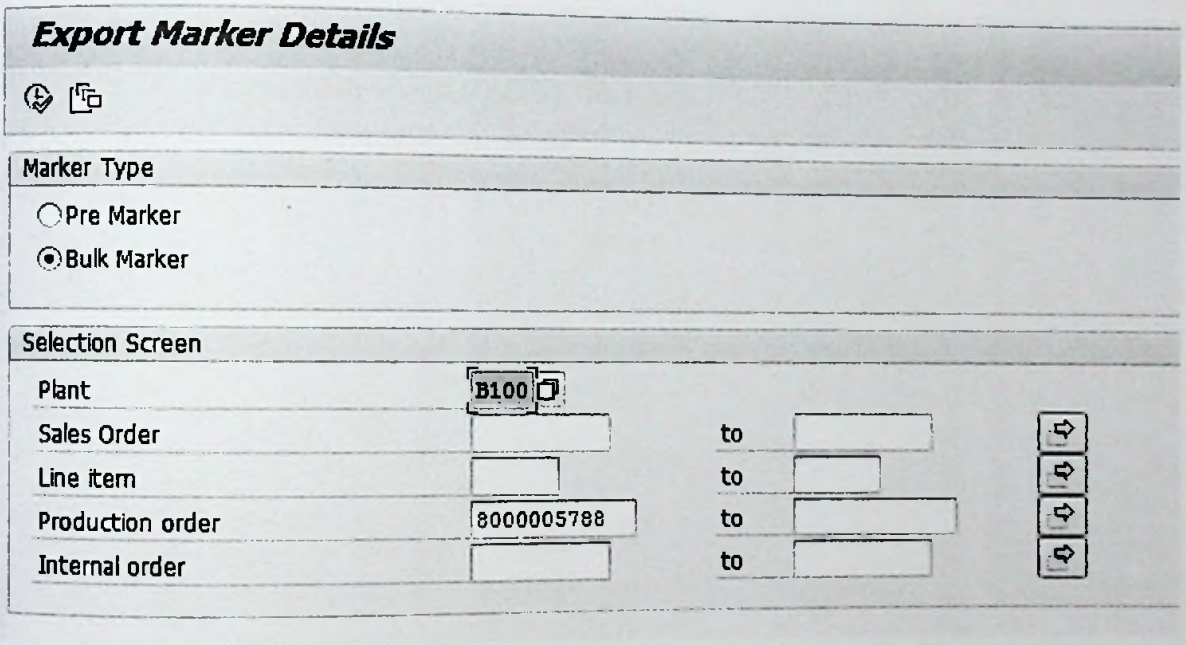


Figure 32:Export Marker Details

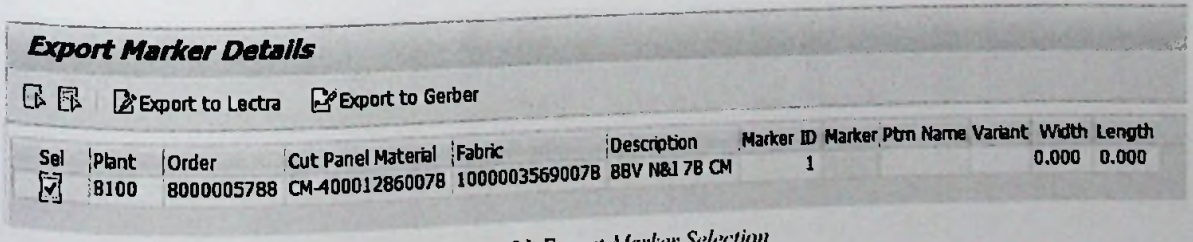


Figure 33:Export Marker Selection

6.10.1. File Types of expert CAD details.

There are two main external system is used to draw maker details.

- **Lectra File Format (.MKX file type)**

```
*-----File Template --------------
***
*begin_of_marker
*marker_name=shirt002TEST
*width_value=14000
*fabric_constraint_name=NR
*fabric_type=S
*non_marked_pieces_number=6
*begin_of_model
*model_file_name=SHIRT   //pattern Name
*model_file_name_extension=MDL
*model_variant=shirt     //Varient Name
*model_size=S::
*model_quantity=3
*end_of_model
*end_of_marker
*---------------------------------
```

Figure 34:Lectra export CAD details template

- **Gerber File Format (.CSV file type).**

```
*------Gerber Template-----
*=:order              #Start order data
*o:MAS                #Order name/Marker name
*w:60.0               #Width.
*m:Ladies-Blouse      #Model name/Pattern name
*q:1                  # one size 12
*s:12
*q:2
*s:14                  # two size 14
*
*o:MAS-123             #Order name
*w:60.0                #Width.
*m:Ladies-Blouse       #Model name
*q:1                   # one size 12
*s:12
*q:2
*s:14                   # two size 14
*---------------------------------------
```

Figure 35:Gerber export CAD details template

6.11. Android application for Manager Approval.

- PI connection for integrate SAP and Android Application.
- Android application for QR code reading and communicate with SAP System.

- Secure way to communication with Central Database using RFC Request and Respond through the SAP PI system.

6.12. Summary.

This chapter was about implementation of the SAP ERP based lay planning program. It described about the major modules that it has and about the main functionalities which each module is equipped with. Next chapter will describe about how the evaluation was done of proposed solution and details of whether the objectives have been achieved using test cases. Further it'll discuss on drawbacks and limitations of the proposed solution.

7. Evaluation.

7.1. Introduction.

Previous chapter has described on how the Lay planning workbench is implemented. In this section, we will evaluate the solution which is the Maker planning system and the evaluation method is observing the usage and calculation of marker lay planning and exporting marker data. This will go through the test cases which were used to evaluate the system. Further we will discuss whether the system meets the goal and objectives that we have discussed earlier. In addition, we will discuss about the performance and the time reduced and increasing the efficiency and effectiveness of the ratio calculation for fabric cutting. This chapter would also discuss on how the data was gathered and how it was analyzed using the observation method and has been compared with previous daily work carried out by the developers and their experience after implementing ratio planning process. This chapter would address specific advantages the users to optimize the fabric cutting process.

7.2. Verification and Validation.

From the customers point of view this is the most important part of the software designed life cycle. With regard to the Ratio Planning program SAP proposed solution. It's a very vital to validate and verify with the objectives it designed. Since this will be intend to use in an apparel production plant to capture the production in/out it's should be well accurate. In any non-conformity of the system could result the whole production facility stand still.

According to the software engineering literature definitions for verification and validation are as follows.

- Verification: Are we building the software right
- Validation: Are we building the right software

Verification of the software deals with the software development methodology. Software should meet its specification. Verification confirms the software product meets it's specifications like functional and nonfunctional requirements. Validation confirms beyond the specification requirements. Generally the specification may not contain all the customer

requirements. But by validation process we must ensure the software is produced up to the satisfaction of customer. By performing above procedures, we can confirm the software product is ready to use. It developed the confidence in both customer and developer. Verification and validation can be tested from below methodologies.

7.3. SAP lay Planning Workbench testing approach.

Evaluation of proposed system is important step of the SAP R/3 implementation. Testing process is the main critical step and mainly testing have to done in two main SAP environment.

- Development SAP Box testing (DEV System)
- Quality SAP Box testing (QDM System)

Development Box testing (DEV System) has been done by development team and the MAS SBU users. Dev System testing mainly focused on the testing each ratio planning implementation. Mainly testing done according to the functional specification and validate the each requirement has been full fill or not.

Quality SAP Box testing (QDM System) has been done after transport all the implementation of proposed solution. With the new test scenarios cases in new SAP environments.

7.4. Test cases for testing each functionality - Template for each scenarios

Test Case ID		1		
Tested Component		Auto Ratio Calculation		
Tested Area		Functionality / Calculation		
Purpose		Check the Proposed value with existing excel functionality.		
Prerequisites		• Check order details (SO / Production/Internal Order) • Read the BOM for finish good Martials. • Select the each ratio planning data. • Enter the Auto ratio parameters.		
		Test Case Description		
No.	Test Case	Test data	Expected output	Result
1	1st marker	Sales order: 1000026381 Line item :10	Estimated length: 6.672	Pass

		Plant C055	Estimated Fab Req: 5,337.600	
2	2nd marker	Sales order: 1000026381 Line item :10 Plant C055 Fabric: CM-7000031620	Estimated length: 4.448 Estimated Fab Req: 444.800	Pass
Expected Output				

Descriptions	D...	R...	C...	Mark ID	# Plies	# Dock	L	M	S	XL	Total	Est.Length	Est Fab Req
Order Qty	☐	☐	☐				2,400	2,800	2,400	2,800	10,400		
Sample Qty	☐	☐	☐				0	0	0	0	0		
Wastage Qty	☐	☐	☐				0	0	0	0	0		
Consumption	☐	☐	☐				0.556	0.556	0.556	0.556	0		
Total Qty	☐	☐	☐				2,400	2,800	2,400	2,800	10,400		
Ratio	☐	☐	☐	1	800	1	3	3	3	3	12	6.672	5,337.600
Cut Qty	☐	☐	☐				2,400	2,400	2,400	2,400	9,600		
Per Docket Qty	☐	☐	☐				2,400	2,400	2,400	2,400	9,600		
% Size Plan	☐	☐	☐				100	85.714	100	85.714	0		
Balance Qty	☐	☐	☐				0	400	0	400	800		
Ratio	☐	☐	☐	2	100	1	0	4	0	4	8	4.448	444.800
Cut Qty	☐	☐	☐				0	400	0	400	800		
Per Docket Qty	☐	☐	☐				0	400	0	400	800		
% Size Plan	☐	☐	☐				100	100	100	100	0		
Balance Qty	☐	☐	☐				0	0	0	0	0		

Table 11: Test Case for each unit testing

7.5. Unit testing.

A unit test is a procedure used to validate that a particular module of source code is working properly. The procedure is to write test cases for all functions and methods so that whenever a change causes a regression, it can be quickly identified and fixed. Ideally, each test case is separate from the others, constructs such as mock objects can assist in separating unit tests. Unit testing is mostly done by the developers and not by end-users. In Lay planning ratio calculation system is breakdown into each isolated pieces of functionality and test with the functional requirements.

- Ratio Plan for
    - Sales Orders (Clubbing multiple sales orders)
    - Production Orders (Clubbing multiple Production Orders)
    - Cut / Swing Order OR Internal Order
- Read the material requirement for each panel and fabric
- Ratio Planning based on grid values (Size wise)
    - Auto Ratio

- Manual Ratio
- Optimize ratios
- Auto Calculation
- Search Ratio
- Delete / Add / Rest Copy Ratio details

- Print & Save Marker Data
- Status (Level of Authorizations)
  - Stated
  - Marker Pending
  - Completed – Provide Mobile based approval process for Mangers by using QR code Reader.
  - Reopen
- Summary (Decision making information).

7.6. Integration testing.

This testing is similar to scenario testing except it is typically done in the QA environment and uses more realistic data. Ideally the data has come from a near real data extraction, conversion and load exercise (not necessarily a full conversion) so the data has a certain familiarity to it for a business end user. Test above each functionality as a whole system. Creating test script for each functionality and integrating each functionality as a system. The testing shows that the business process as designed and configured in SAP runs using representative real world data. In addition the testing shows interface triggers, reports, workflow are working.

Integration testing main scenarios.

- Read Order details
- Read BOM and Display
- Auto / Semi auto and manual ratio calculation
- Status Change (Start / send to CAD/ Complete / Reopen)
- Export to CAD system to drown marker.

7.7. SAP End User Testing & User Acceptance Testing.

I grouped these two together because they are closely related, if not identical. The goal here is to ensure that end users are able to perform their designated job functions with the new system(s). A crucial part of this testing is referring back to the business requirements and blueprint to ensure that the expected features, functions and capabilities are available. As part of the project user involvement along the way should have been providing feedback to ensure the design met the requirements, so there should not be any big surprises again this is activity that usually occurs in a QA environment with realistic data and the inclusion of end user security and authorizations.

In this scenario each SBU user have to testing and need to validate the each functionalities are fitted into their business requirements accepting to the transport each changes to production environments.

7.8. Performance testing.

This kind of testing examines things like whether the system response time is acceptable, whether periodic processes run quickly enough, whether the expected concurrent user load can be supported to calculate the ratio planning. It also identifies processing bottlenecks and ABAP coding inefficiencies. It is rare for a project to have worked out all the system performance tuning perfectly ahead and to have every program running optimized code. Consequently the first stress test on a system can be painful as lots of little things pop up that weren't necessarily an issue in isolated testing.

The testing is geared towards simulating peak loads of activity, either online users or periodic batch processing, and identifies the steps needed to improve performance. Given that the initial test reveals lots of areas for improvement you should expect to run through this a couple of times to ensure the results are good.

7.9. Proposed Solution Go-Live / Roll-out

Go live means transport all proposed system functionality to SAP Production live system.

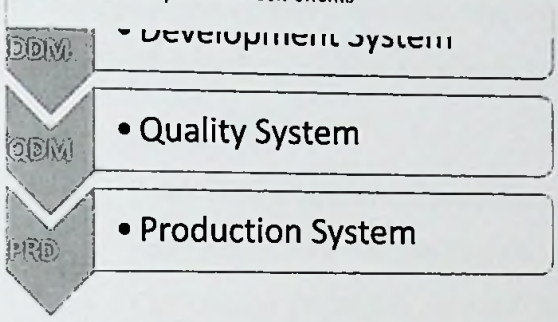
7.10. Proposed Solution Go-Live / Roll-out

Go live means transport all proposed system functionality to SAP Production live system.

7.11. Summary.

This chapter fully discussed about the evaluation and the testing of the system according to the aim and objectives defined. Results of this evaluation were given to MAS each SBU users. Next chapter will discuss on the conclusion and further works of the project.

Figure 36:Transport between clients



8. Conclusion and further work.

8.1. Introduction.

Overall achievement of the SAP ERP lay planning management workbench for MAS Holdings -Solution for SAP Apparel and Footwear Manufacturing Plants is completed and successful. Following are the tasks which was targeted by the system.

- Identify and rectify existing issues related to ratio calculating for fabric cutting process through comprehensive research and the project looks at solving these issues by proposing both a business as well as an IT solution.
    - Ratio Plan for
        - Sales Orders (Clubbing multiple sales orders)
        - Production Orders (Clubbing multiple Production Orders)
        - Cut / Swing Order OR Internal Order
    - Read the material requirement for each panel and fabric
    - Ratio Planning based on grid values (Size wise)
        - Auto Ratio.
        - Manual Ratio.
        - Optimize ratios.
        - Auto Calculation.
        - Search Ratio.
        - Delete / Add / Rest Copy Ratio details
    - Print & Save Marker Data
    - Status (Level of Authorizations)
        - Stated
        - Marker Pending
        - Completed – Provide Mobile based approval process for Mangers by using QR code Reader.
        - Reopen
    - Summary (Decision making information).

- Proposed solution should be integrated with other existing systems. (CAD System / Docket creation program / Marker history report & etc.)
- Different level authorization to optimized ratio creation process.
- Automated ratio calculation and inline ratio changing capability.

8.2. Conclusion

Overall achievement of the SAP ERP lay planning management workbench for MAS Holdings -Solution for SAP Apparel and Footwear Manufacturing Plants achieved successfully. By studying how the users of the system is interacted we can see that it can reduce their fabric cutting process and minimize the fabric wastage.

I'm pleased to mention that I've gone through various validation mechanisms, to optimize the ratio planning and integrating with the other process to streamline the fabric cutting process to optimize through the effective ratio planning.

The project enables for solving these issues by proposing both a business as well as an IT solution. Business solution is directly provide solution for day to day fabric cutting process activities efficiently and effectively, deducts overall cost through the minimizing fabric requirement and increased employee satisfaction. Proposed SAP solution is used high technology to calculating cutting ratio automatically and integrated with other programs to streamline and optimized business process. It's provided all-rounded solution to avoid above problems.

As a conclusion, SAP ERP lay planning management workbench for MAS Holdings was a successful research and achieved its goals.

- Optimize the fabric cutting process.
- Streamline the ratio planning with fabric cutting.
- Deduct the overall cost of fabric through the optimization.
- Improve the employee satisfaction.

8.3. Further Enhancement

- Proposed Solution need to transport to the production environment.
- Convert Lay planning system into web based solution (feiori application).

8.4. Summery

This chapter provided a conclusion of overall solution achieved by the Research project named SAP ERP lay planning management workbench for MAS Holdings - Solution for SAP Apparel and Footwear Manufacturing Plants done at faculty of IT at University of Moratuwa and further work as an enhancement of the current project.

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[5] ("Leading Manufacturer of Intimate Apparel, Sportswear, Performance Wear and Swimwear | MAS - Change Is Courage," n.d.)

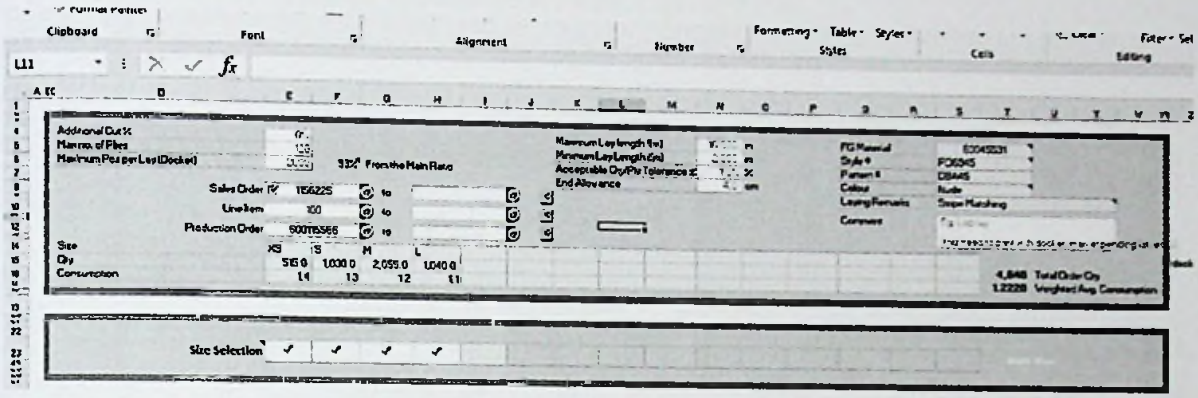
[7] ("Apparel: Design, Textiles & Construction, 10th Edition," n.d.)

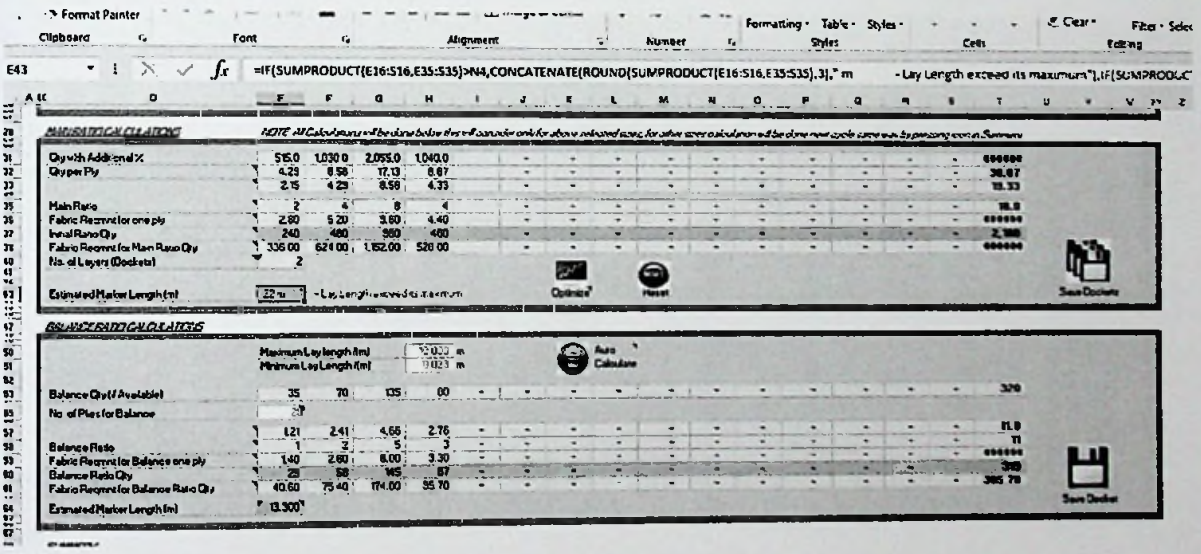
[8] ("A Study of Productivity and Financial Efficiency of Textile Industry of India," 2010)

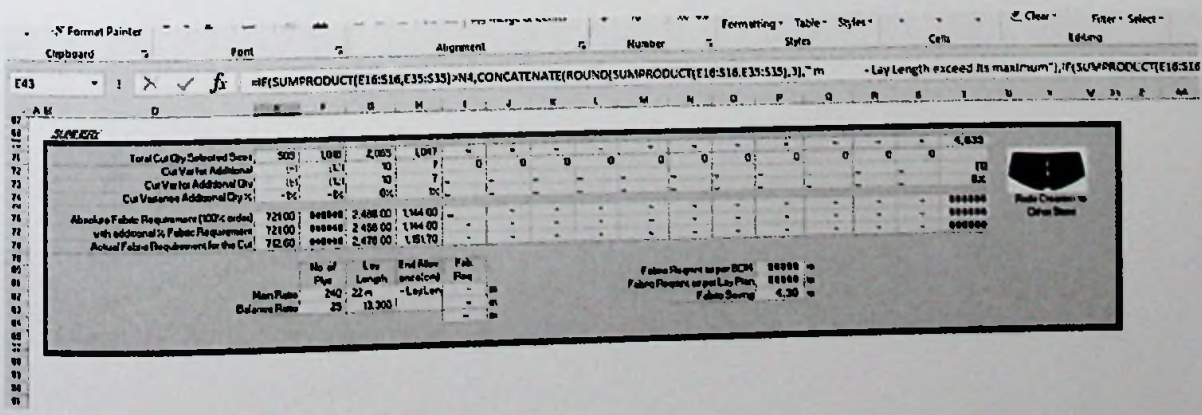
Appendix A

Existing system Details

Excel based ratio Planning Sheet.



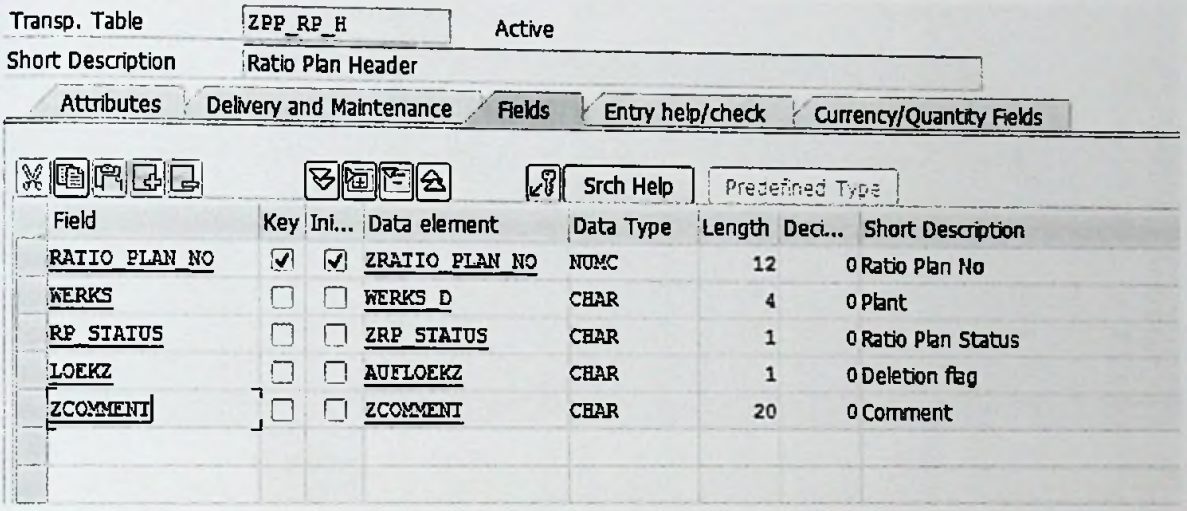




Appendix B

SAP Based Proposed system implementation details.

1. Databased table Structures.



Transp. Table ZPP_RP_H Active

Short Description Ratio Plan Header

Attributes | Delivery and Maintenance | Fields | Entry help/check | Currency/Quantity Fields

Srch Help | Predefined Type

Field	Key	Ini...	Data element	Data Type	Length	Deci...	Short Description
RATIO_PLAN_NO	☑	☑	ZRATIO_PLAN_NO	NUMC	12	0	Ratio Plan No
WERKS	☐	☐	WERKS_D	CHAR	4	0	Plant
RP_STATUS	☐	☐	ZRP_STATUS	CHAR	1	0	Ratio Plan Status
LOEKZ	☐	☐	AUFLOEKZ	CHAR	1	0	Deletion flag
ZCOMMENT	☐	☐	ZCOMMENT	CHAR	20	0	Comment

Transp. Table ZPP_RP_SO Active

Short Description Ratio Plan Sales Orders

Attributes | Delivery and Maintenance | Fields | Entry help/check | Currency/Quantity Fields

Srch Help | Predefined Type

Field	Key	Ini...	Data element	Data Type	Length	Deci...	Short Description
MANDT	☑	☑	MANDT	CLNT	3	0	Client
RATIO_PLAN_NO	☑	☑	ZRATIO_PLAN_NO	NUMC	12	0	Ratio Plan No
VBELN	☑	☑	VBELN_VA	CHAR	10	0	Sales Document
POSNR	☑	☑	POSNR_VA	NUMC	6	0	Sales Document Item
AUFNR	☑	☑	AUFNR	CHAR	12	0	Order Number
ORD_NO	☑	☑	ZORD_NO	CHAR	10	0	Internal Order Number
WERKS	☐	☐	WERKS_D	CHAR	4	0	Plant
WASTAGE	☐	☐	ZWASTAGE_D	QUAN	13	3	Wastage
MARKER_TYPE	☐	☐	ZMARKER_TYPE	CHAR	1	0	Marker Type
ORD_QTY	☐	☐	WMENG	QUAN	13	3	Order quantity in sales units
MATNR	☐	☐	MATNR	CHAR	18	0	Material Number
ZZCUST_STYLE	☐	☐	ZCUST_STYLE	CHAR	20	0	Customer Style
ZDATE	☐	☐	ZMDATE	DATS	8	0	Modification date
UNAME	☐	☐	UNAME	CHAR	12	0	User Name

Transp. Table ZPP_RP_PANEL Active

Short Description Ratio Plan Panels

Attributes | Delivery and Maintenance | Fields | Entry help/check | Currency/Quantity Fields

Srch Help | Predefined Type

Field	Key	Ini...	Data element	Data Type	Length	Deci...	Short Description
MANDT	☑	☑	MANDT	CLNT	3	0	Client
RATIO_PLAN_NO	☑	☑	ZRATIO_PLAN_NO	NUMC	12	0	Ratio Plan No
FG_MATNR	☑	☑	MATNR	CHAR	18	0	Material Number
CUI_MATNR	☑	☑	MATNR	CHAR	18	0	Material Number
FAB_MATNR	☑	☑	MATNR	CHAR	18	0	Material Number
WERKS	☐	☐	WERKS_D	CHAR	4	0	Plant
DELI	☐	☐	FLAG	CHAR	1	0	General Flag
PANEL_STATUS	☐	☐	ZPANEL_STATUS	CHAR	1	0	Panel Status
COMMENTS	☐	☐	CHAR200	CHAR	200	0	Text field length 200
FAB_WASTAGE	☐	☐	ZWASTAGE_D	QUAN	13	3	Wastage
COM_SEQ	☐	☐	ZCOM_SEQ	INT1	3	0	fabric Combine Sequence

Transp. Table ZPP_RP_D Active

Short Description Ratio Plan Detail

Attributes | Delivery and Maintenance | Fields | Entry help/check | Currency/Quantity Fields

Srch Help | Predefined Type

Field	Key	Ini...	Data element	Data Type	Length	Deci...	Short Description
MANDT	☑	☑	MANDT	CLNT	3	0	Client
RATIO_PLAN_NO	☑	☑	ZRATIO_PLAN_NO	NUMC	12	0	Ratio Plan No
CUT_MATNR	☑	☑	ZCUT_MATNR	CHAR	18	0	Cut Panel Material
FAB_MATNR	☑	☑	ZFAB_MATNR	CHAR	18	0	Fabric
J_3ASIZE	☑	☑	J_3ASIZE	CHAR	8	0	Grid Value
MARKER_ID	☑	☑	ZMARKER_NO	NUMC	3	0	Marker ID
WERKS	☐	☐	WERKS_D	CHAR	4	0	Plant
MARKER_NO	☐	☐	ZMARKER_NAME	CHAR	20	0	Marker Name
ORD_QTY	☐	☐	ZORD_QTY	QUAN	13	3	Order Quantity
SAMPLE_QTY	☐	☐	ZSAMPLE_QTY	QUAN	13	3	Sample QuantitySample Quantity
ALLOWANCE	☐	☐	ZALLOWANCE	QUAN	13	3	Allowance
WASTAGE	☐	☐	ZWASTAGE_D	QUAN	13	3	Wastage
CONSUMPTION	☐	☐	ZCONSUM	QUAN	13	3	Consumption
NO_OF_PLIES	☐	☐	ZNO_OF_PLIES	NUMC	4	0	Number of Plies
NO_DOCKETS	☐	☐	ZNO_DOCKETS	NUMC	4	0	Number of Dockets
RATIO	☐	☐	ZRATIO	NUMC	4	0	RATIO
WIDTH	☐	☐	ZWIDTH_L	QUAN	13	3	Width

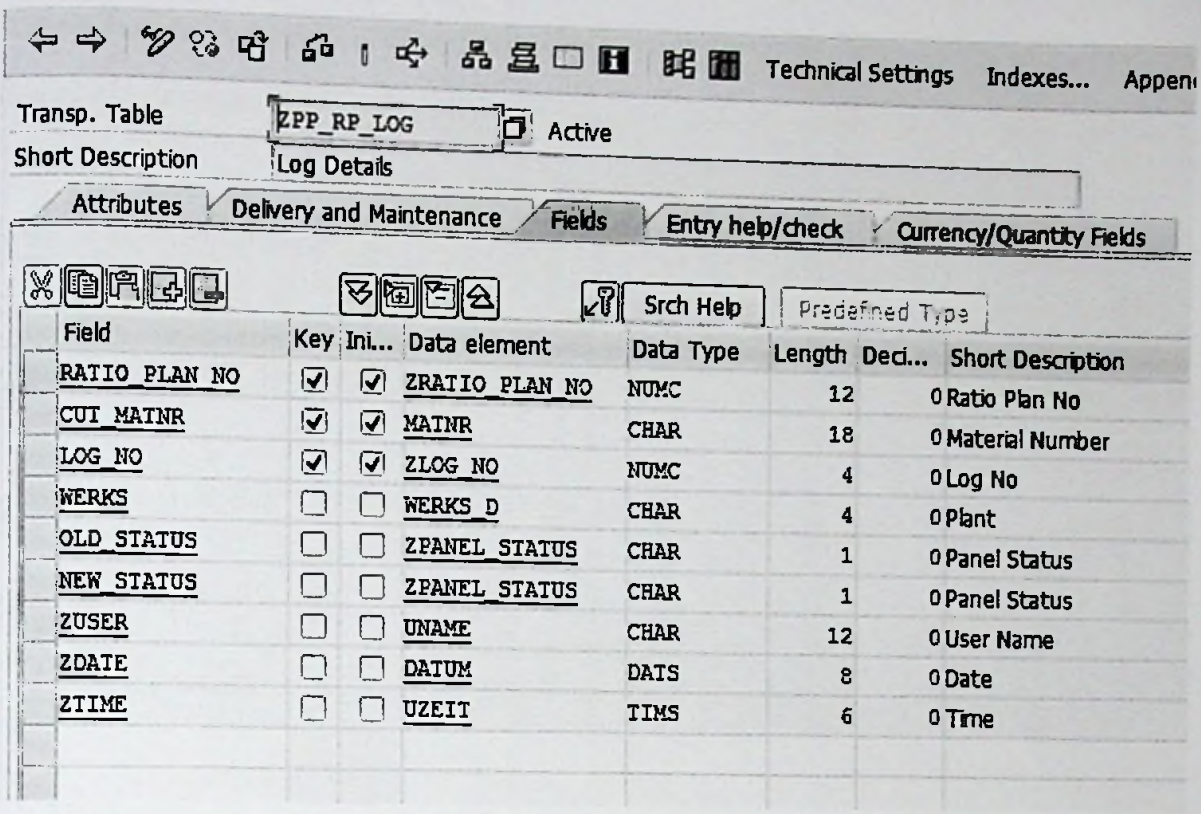
Transp. Table ZPP_RP_PANEL Active

Short Description Ratio Plan Panels

Attributes | Delivery and Maintenance | Fields | Entry help/check | Currency/Quantity Fields

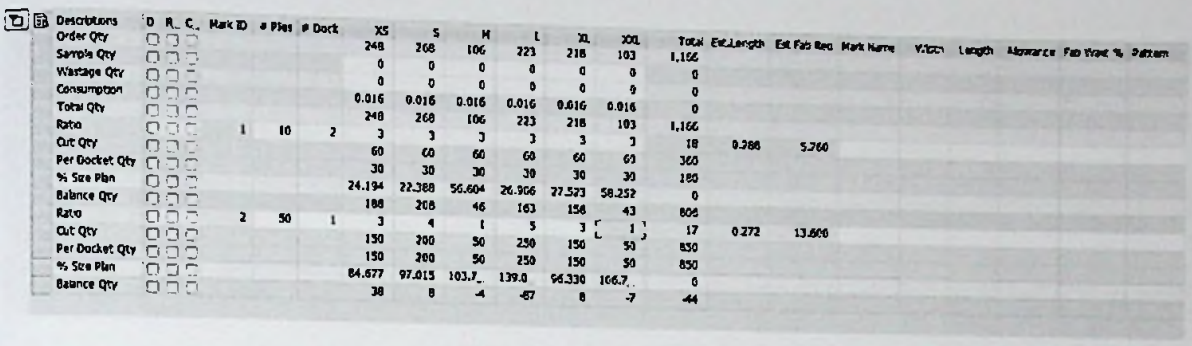
Srch Help | Predefined Type

Field	Key	Ini...	Data element	Data Type	Length	Deci...	Short Description
MANDT	☑	☑	MANDT	CLNT	3	0	Client
RATIO_PLAN_NO	☑	☑	ZRATIO_PLAN_NO	NUMC	12	0	Ratio Plan No
FG_MATNR	☑	☑	MATNR	CHAR	18	0	Material Number
CUT_MATNR	☑	☑	MATNR	CHAR	18	0	Material Number
FAB_MATNR	☑	☑	MATNR	CHAR	18	0	Material Number
WERKS	☐	☐	WERKS_D	CHAR	4	0	Plant
DFLT	☐	☐	FLAG	CHAR	1	0	General Flag
PANEL_STATUS	☐	☐	ZPANEL_STATUS	CHAR	1	0	Panel Status
COMMENTS	☐	☐	CHAR200	CHAR	200	0	Text field length 200
FAB_WASTAGE	☐	☐	ZWASTAGE_D	QUAN	13	3	Wastage
COM_SEQ	☐	☐	ZCOM_SEQ	INT1	3	0	fabric Combine Sequence



Field	Key	Ini...	Data element	Data Type	Length	Deci...	Short Description
RATIO_PLAN_NO	☑	☑	ZRATIO_PLAN_NO	NUMC	12	0	Ratio Plan No
CUT_MATNR	☑	☑	MATNR	CHAR	18	0	Material Number
LOG_NO	☑	☑	ZLOG_NO	NUMC	4	0	Log No
WERKS	☐	☐	WERKS_D	CHAR	4	0	Plant
OLD_STATUS	☐	☐	ZPANEL_STATUS	CHAR	1	0	Panel Status
NEW_STATUS	☐	☐	ZPANEL_STATUS	CHAR	1	0	Panel Status
ZUSER	☐	☐	UNAME	CHAR	12	0	User Name
ZDATE	☐	☐	DATUM	DATS	8	0	Date
ZTIME	☐	☐	UZEIT	TIMS	6	0	Time

Appendixes for Auto Ratio calculation code.



Descriptions	D	R	C	Mark ID	# Plies	# Dock	XS	S	M	L	XL	XXL	Total	Est Length	Est Fab Req	Mark Name	Width	Length	Allowance	Fab Width %	Pattern
Order Qty							248	268	106	223	218	103	1,166								
Sample Qty							0	0	0	0	0	0	0								
Wastage Qty							0	0	0	0	0	0	0								
Consumption							0.016	0.016	0.016	0.016	0.016	0.016	0								
Total Qty							248	268	106	223	218	103	1,166								
Ratio				1	10	2	3	3	3	3	3	3	18	0.288	5.760						
Cut Qty							60	60	60	60	60	60	360								
Per Docket Qty							30	30	30	30	30	30	180								
% Size Plan							24.194	22.388	56.604	26.906	27.523	58.252	0								
Balance Qty							188	208	46	163	158	43	806								
Ratio				2	50	1	3	4	1	5	3	1	17	0.272	13.600						
Cut Qty							150	200	50	250	150	50	850								
Per Docket Qty							150	200	50	250	150	50	850								
% Size Plan							84.677	97.015	103.7_	139.0	96.330	106.7_	0								
Balance Qty							38	8	-4	-67	8	-7	-44								

```
DATA: li_sku_tem  TYPE TABLE OF tfl_sku.

  DATA: wa_flname(20)          TYPE c,
        lv_wastage             TYPE menge_d,
        lv_plies               TYPE menge_d,
        lv_totcut              TYPE menge_d,
        lv_dockets             TYPE menge_d,
        lv_totratio            TYPE menge_d,
        lv_mak_id              TYPE menge_d,
        lv_length              TYPE menge_d,
        lv_allow               TYPE menge_d,
        lv_est_length          TYPE menge_d,
        lv_round_val           TYPE menge_d,
        lv_ral_val             TYPE menge_d,
        lv_incri_val           TYPE menge_d,
        lv_tolren              TYPE menge_d,
        lv_sum_val             TYPE menge_d,
        lv_sum_seletd_qty      TYPE menge_d,
        lv_cut_spe             TYPE flag.

  CLEAR:lv_est_length,lv_allow,lv_length,lv_totratio,lv_dockets,
        lv_totcut,lv_plies,lv_wastage,gv_tot_wat,gv_tot_coun,gv_bal_falg,
        gv_bal_falg,lv_sum_val,lv_sum_seletd_qty.


  li_sku_tem = gi_sku.

*---get the Selected size Qty
  LOOP AT gi_sku ASSIGNING <fs_sku>.
    READ TABLE gi_gridval INTO gwa_gridval WITH KEY j_3asize = <fs_sku>-
j_3asize.  "Grid Mapping
```

```
    IF sy-subrc = 0.
      READ TABLE gi_selec_cell TRANSPORTING NO FIELDS WITH KEY fieldname =
gwa_gridval-feild.
      IF sy-subrc = 0.
        lv_sum_seletd_qty = lv_sum_seletd_qty + <fs_sku>-kwmeng.
      ENDIF.
    ENDIF.
  ENDLOOP.

*---Do calculations in itab
  lv_row = 0.
  LOOP AT <t_dyntable> ASSIGNING <fs_dyntable>.
    lv_row = lv_row + 1.
    CHECK lv_row <> '1'.

    wa_flname = 'IND'. "Indicator
    ASSIGN COMPONENT  wa_flname OF STRUCTURE <fs_dyntable> TO <fs_fldval>.


******************** Process the Sample Qty ******************

    IF <fs_fldval> = 'A'.
      LOOP AT gi_sku ASSIGNING <fs_sku>.
        IF gv_dif_style = abap_true.
          wa_flname = <fs_sku>-size_order.
        ELSE.
          wa_flname = <fs_sku>-j_3asize.
        ENDIF.

        READ TABLE gi_gridval INTO gwa_gridval WITH KEY j_3asize = wa_flnam
e.  "Grid Mapping
        IF sy-subrc = 0.
          wa_flname = gwa_gridval-feild.

          READ TABLE gi_selec_cell TRANSPORTING NO FIELDS WITH KEY fieldnam
e = wa_flname.
          IF sy-subrc = 0.
            ASSIGN COMPONENT  wa_flname OF STRUCTURE <fs_dyntable> TO <fs_f
ldval>.
            <fs_sku>-sample_qty = <fs_fldval>.
            lv_sum_val = lv_sum_val + <fs_sku>-sample_qty .
```

```
          ENDIF.
        ENDIF.
      ENDLOOP."End of sample Qty


      "---Sum of sample Qty
      IF lv_sum_val IS NOT INITIAL.
        wa_flname = 'TOT_RATIO'.
        ASSIGN COMPONENT  wa_flname OF STRUCTURE <fs_dyntable> TO <fs_fldva
l>.
        <fs_fldval> = lv_sum_val.
        CLEAR:lv_sum_val.
      ENDIF.


***************** Process the Wastage ******************
    ELSEIF  <fs_fldval> = 'B'.
      LOOP AT gi_sku ASSIGNING <fs_sku>.
        IF gv_dif_style = abap_true.
          wa_flname = <fs_sku>-size_order.
        ELSE.
          wa_flname = <fs_sku>-j_3asize.
        ENDIF.

        READ TABLE gi_gridval INTO gwa_gridval WITH KEY j_3asize = wa_flnam
e.  "Grid Mapping
        IF sy-subrc = 0.
          wa_flname = gwa_gridval-feild.

          READ TABLE gi_selec_cell TRANSPORTING NO FIELDS WITH KEY fieldnam
e = wa_flname.
          IF sy-subrc = 0.
            ASSIGN COMPONENT  wa_flname OF STRUCTURE <fs_dyntable> TO <fs_f
ldval>.
            <fs_sku>-wastage = <fs_fldval>.
            gv_tot_wat = gv_tot_wat + <fs_fldval>.
            CLEAR: lv_wastage,wa_flname.
          ENDIF.
        ENDIF.
      ENDLOOP."End of cal wastage
```

```
      IF gv_tot_wat IS NOT INITIAL.
        "Sum of wastage Qty
        wa_flname = 'TOT_RATIO'.
        ASSIGN COMPONENT  wa_flname OF STRUCTURE <fs_dyntable> TO <fs_fldva
l>.
        <fs_fldval> = gv_tot_wat.
      ENDIF.


****************** Process the Total Qty ********************

    ELSEIF  <fs_fldval> = 'C'.
      LOOP AT gi_sku ASSIGNING <fs_sku>.
        IF gv_dif_style = abap_true.
          wa_flname = <fs_sku>-size_order.
        ELSE.
          wa_flname = <fs_sku>-j_3asize.
        ENDIF.

        READ TABLE gi_gridval INTO gwa_gridval WITH KEY j_3asize = wa_flnam
e.  "Grid Mapping
        IF sy-subrc = 0.
          wa_flname = gwa_gridval-feild.
          READ TABLE gi_selec_cell TRANSPORTING NO FIELDS WITH KEY fieldnam
e = wa_flname.
          IF sy-subrc = 0.
            ASSIGN COMPONENT  wa_flname OF STRUCTURE <fs_dyntable> TO <fs_f
ldval>.
            <fs_sku>-tot_qty = <fs_sku>-kwmeng + <fs_sku>-
sample_qty + <fs_sku>-wastage.
            <fs_fldval>      = <fs_sku>-tot_qty. "Total Qty For Size wise
            lv_totcut        = lv_totcut + <fs_sku>-tot_qty.
          ENDIF.
        ENDIF.

      ENDLOOP.

      "Sum of Cut Qty
      IF lv_totcut IS NOT INITIAL.
        wa_flname = 'TOT_RATIO'.
        ASSIGN COMPONENT  wa_flname
```

```
          OF STRUCTURE <fs_dyntable> TO <fs_fldval>.
        <fs_fldval> = lv_totcut.
      ENDIF.

**************Process the Consuptions Data***************

    ELSEIF  <fs_fldval> = 'D'.
      LOOP AT gi_sku ASSIGNING <fs_sku>.
        IF gv_dif_style = abap_true.
          wa_flname = <fs_sku>-size_order.
        ELSE.
          wa_flname = <fs_sku>-j_3asize.
        ENDIF.

        READ TABLE gi_gridval INTO gwa_gridval WITH KEY j_3asize = wa_flnam
e.  "Grid Mapping
        IF sy-subrc = 0.
          wa_flname = gwa_gridval-feild.
          READ TABLE gi_selec_cell TRANSPORTING NO FIELDS WITH KEY fieldnam
e = wa_flname.
          IF sy-subrc = 0.
            ASSIGN COMPONENT wa_flname OF STRUCTURE <fs_dyntable> TO <fs_fl
dval>.
            <fs_sku>-consumption = <fs_fldval> .
            gv_tot_coun = gv_tot_coun + <fs_sku>-consumption.
          ENDIF.
        ENDIF.
      ENDLOOP.

*************** PROCESS THE RATIO CALCULATION **********************

    ELSEIF  <fs_fldval> = 'X'.
*---Size wise ratio calculation
      IF lv_row = 6.

        wa_flname = 'MARKER_ID'.
        ASSIGN COMPONENT  wa_flname OF STRUCTURE <fs_dyntable> TO <fs_fldva
l>.
        lv_mak_id = <fs_fldval>.
        CLEAR:wa_flname.
```

```
        lv_plies = 0.
        wa_flname = 'PLIES'.
        ASSIGN COMPONENT  wa_flname OF STRUCTURE <fs_dyntable> TO <fs_fldva
l>.
        IF sy-ucomm = 'AUTO_R'.
          <fs_fldval> = gwa_ratio_para-max_plies.
        ENDIF.
        lv_plies    = <fs_fldval>.


        "get the Cut Speratly Indication
        wa_flname = 'C_CUT'.
        ASSIGN COMPONENT  wa_flname OF STRUCTURE <fs_dyntable> TO <fs_fldva
l>.
        lv_cut_spe = <fs_fldval>.

*----Claculate the number of Dockets
        wa_flname = 'DOCKETS'.
        ASSIGN COMPONENT  wa_flname OF STRUCTURE <fs_dyntable> TO <fs_fldva
l>.

*         IF sy-ucomm = 'OPTIMIZE'. "For Optimaze
*           <fs_fldval> = <fs_fldval> + 1.
*
*         ELSEIF sy-ucomm = 'AUTO_R'.
        IF gwa_ratio_para-max_dkt_pcs <> 0.

*           <fs_fldval> = trunc( gv_tot_qty / gwa_ratio_para-max_dkt_pcs ).
          <fs_fldval> = trunc( lv_sum_seletd_qty / gwa_ratio_para-
max_dkt_pcs ).
          IF <fs_fldval> IS INITIAL.
            <fs_fldval> = 1.
          ENDIF.
        ENDIF.
*         ENDIF.
        lv_dockets  = <fs_fldval>.
        CLEAR:wa_flname,gwa_gridval."end of cal # of dokets

*---Calculate the total ratio for First Ratio
        LOOP AT gi_sku ASSIGNING <fs_sku>.
          IF gv_dif_style = abap_true.
```

```
            wa_flname = <fs_sku>-size_order.
          ELSE.
            wa_flname = <fs_sku>-j_3asize.
          ENDIF.

          READ TABLE gi_gridval INTO gwa_gridval WITH KEY j_3asize = wa_fln
ame.   "Grid Mapping
          IF sy-subrc = 0.
            wa_flname = gwa_gridval-feild.
            ASSIGN COMPONENT  wa_flname OF STRUCTURE <fs_dyntable> TO <fs_f
ldval>.

            IF ( lv_dockets * gwa_ratio_para-max_plies ) <> 0.

*               IF sy-
ucomm = 'OPTIMIZE' AND <fs_fldval> <> 0. "For Optimaze.
*                 lv_ral_val = <fs_sku>-
tot_qty / ( lv_dockets * gwa_ratio_para-max_plies ).
*               ELSE.
              READ TABLE gi_selec_cell TRANSPORTING NO FIELDS WITH KEY fiel
dname = wa_flname.
              IF sy-subrc = 0.
                lv_ral_val = <fs_sku>-
tot_qty / ( lv_dockets * gwa_ratio_para-max_plies ).
              ENDIF.
*               ENDIF.

            ENDIF.
```