IMPROVING TIME AND ACTION (TNA) PLAN IN APPAREL INDUSTRY USING INTEGRATED PRODUCTION PLANNING AND CONTROL SOFTWARE - A CASE STUDY

by

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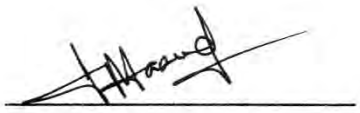

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It is hereby declared that this thesis or any part of it has not been submitted elsewhere for the award of any degree or diploma.

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Muhammed Rifat Hossain

This thesis is dedicated to my beloved parents.

Table of Contents

List of Tables

List of Figures

List of Abbreviations of Technical Symbols and Terms

TNA -	Time and Action
PPC -	Production planning and control
ERP -	Enterprise Resource Planning
Vital few	These are the few (20%) independent variables (X's), which contribute to the maximum (80%) of the total variation. These are identified through Pareto Charts.
Trivial many	The trivial many refer to the variables that are least likely responsible for variation in a process, product or service
ROI	Return on Investment

Acknowledgment

All praise goes to Almighty Allah, who bestowed me with the capability and knowledge to accomplish this work.

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Abstract

The apparel industry is the most promising sector in Bangladesh, generating more than 30 billion USD per year. This sector has a lot more to offer, but some challenges are hindering its progress. One of the critical challenges is to ensure the on-time delivery of goods completing all the required tasks within the stipulated timeline. For this, apparel merchandisers usually maintain a Time and Action plan, which is composed of all the required activities with their associated timeline to complete. In the conventional method, this Time and Action plan are maintained using spreadsheet programs. However, discrete spreadsheets lead to the delay in the completion of Time and Action events due to many limitations such as lack of user-friendliness, disconnection among departments, lack of dynamicity. An integrated production planning software offers a solution to these shortcomings. The objective of this research work is to assess whether an integrated production planning and control software can improve the Time and Action Hit rate of an apparel company. For this, an apparel manufacturing company is selected where an integrated production planning software was implemented, and relevant data is available. By comparing the TNA hit rate and event delay data, it was found that TNA hit rate was improved after the implementation of integrated production planning software, and the reasons causing the delay in event completion were also reduced. That means the implementation of integrated production planning software is a better option for the apparel manufacturers in Bangladesh to compete in the global market.

CHAPTER 1
INTRODUCTION

1.1 Introduction

The ready-made garments (RMG) sector of Bangladesh has become the backbone of the economy than any other sector in terms of growth and foreign exchange earnings. It contributed 83.49% to Bangladesh's total exports in 2018 (Ibrahim, 2018). Bangladesh was the second-largest ready-made garments exporter worldwide after China in FY 2017-18 (Textile Today, 2018) accounting $32.4 billion USD of export which is 6.5% of the total $421 billion USD market (Lu, 2019). Recent trends indicate that Bangladesh has been the apparel sourcing hotspot for international retailers and brands for the past few years because of competitive prices and China's declining market share in garment business (Mirdha, 2018). The Apparel manufacturing sector also makes a significant contribution to the socio-economy condition by creating generous employment opportunities and reducing poverty (Islam et al., 2016). The apparel industry is the employer of 40 million workers, mostly rural women.

It is very natural to expect a sector of the nation's economy that is performing so well and contributing so much to the benefit of the nation to be flawless. However, a critical analysis will reveal that there are many shortcomings in our ready-made garment industry. One of the main challenges which are faced by the Bangladeshi ready-made garments suppliers is ensuring finished goods to the customer within the given short lead time. There are many challenges in maintaining the Time and Action (TNA) plan completing all the pre-production activities, which consume more than 70 percent of the order lead time. The poor coordination between multiple departments, e.g. merchandising, commercial, store, planning, production hampers the TNA plan. It results in the delayed shipment of goods or, recovery through expensive alternatives like overtime, subcontract, air shipment etc. These expensive make-up techniques cut the profit margin increasing the operating cost and make survival in the competitive market more difficult. This thesis aims to assess how an integrated production planning and control software can contribute to the on-time completion of preproduction activities thus results in on-time delivery of goods to the customer.

1.2 Research Gap and Motivation

According to the Bangladesh Bank quarterly report on remittance inflows, the export of Ready-made garments is the second largest contributor to the country's net earnings after the foreign remittance. It is known from a report published in Dhaka Tribune (2018) that RMG sector contributes 84 percent of the total export value. Being the most important sector in Bangladesh, Ready-made Garment industry always got the attention of the researcher and academics. There are hundreds of research papers on various RMG industry-related topics such as productivity improvement, Lean tools improvement, Waste reduction etc. Russel (2012) worked on Lean conversion of a traditional assembly line in the garment industry. Alauddin (2018) have done a case study on the process improvement in the Sewing section of a Garments factory. Rahman (2013) worked with quality improvement in Garment factory through the TQM approach. Some researches are there as well focusing on lead time management in the apparel industry. However, most of them are focused towards crushing and minimising the longer lead time to a shorter one to cope-up with the fast-moving fashion trends. Thavanayagam et al. (2010) discussed the application of the Critical Path method for improving the Lead-time of merchandising in Apparel Supply Chain. Nuruzzaman et al. (2009) analysed the business process of the garment sector to find out its lead time minimisation process. However, it is observed that there is no research work focusing on how an integrated production planning and control software can contribute to the Time and Action plan of an apparel business. Hence, it would be exciting to conduct a study in this field.

The apparel industry is getting more and more versatile nowadays. Apparel manufacturers are facing a big challenge of having many separate projects (each style is a project) ongoing at the same time. Each buyer and product type require different activities to be accomplished. It is essential to set evident priorities for each variant to ensure the accomplishment of each activity within their required timeline. Besides, different departments and different personnel inside a department are responsible for different activities. The complexity and a large number of variables involved in managing these activities mean that the traditional tools used by manufacturers, i.e., email and many separate spreadsheets, telephones, back and forth email communications cannot work without a substantial manual workload on the planning

and pre-production. As a result, in most businesses that they fail to achieve on-time completion of their activities. Then they have to firefight and manage exceptions to try to achieve on-time production start and delivery. Integrated production planning and control software solutions are getting popular to overcome these challenges.

Manufacturers from both home and abroad are adopting various software solutions to manage their operations. Software vendors are always claiming their software to bring positive changes in the business. Manufacturers are also sometimes supporting these claims. Sri Lanka based MAS Active, the sports & leisurewear division of MAS Holdings is the fastest growing provider of competition sportswear and leisurewear in the region. Shirendra Lawrence, Managing Director of MAS Active, commented mentioning the benefits they have achieved using FastReactPlan software, "FastReactPlan (a Coats Digital product) supports the business improvement process by providing visibility and coordination to minimise errors and highlights potential problems quickly so that they can be immediately rectified before they become an issue." They also reported that their On-time delivery percentage increased from 80% to 98% using this software (Coats Digital website, 2019). Nilesh Ved, Founder of Apparel Group, said, "Oracle will provide us with a single, global version of the truth and real-time view of inventory and profitability across our vast array of channels and brands. Not only will this enable us to operate smarter, but also elevate the omnichannel experience we are providing our customers" (Oracle Website, 2019). As there is no research works are conducted on this area earlier to asses the contribution of an integrated production planning and control software, it would be enlightening to conduct one and justify the case studies as mentioned above.

1.3 Objectives of the Study

The objectives of this research are:

- To identify, analyze and compute duration for Time and Action (TNA) events of an apparel manufacturing company.
- To find the contribution of integrated production planning and control software in improving the Time and Action Plan.

The outcome of this work is a guideline for our apparel manufacturing industries, whether the implementation of production planning and control software will be a better option to compete in the global apparel market.

1.4 Methodology

The methodology of this research work is a case study research. This case study is conducted in a selected garments company located in Gazipur, Bangladesh. The study gives a comparison of the result of the time and action performance based on the conventional method and production planning and control software-based method.

The methodology followed in this study is as follows:

1. An apparel manufacturing company has been selected where an integrated production planning and control software was implemented, and data related to Time and Action (TNA) are available.
2. Time and Action (TNA) events of the selected company are identified.
3. Data related to Time and Action of different customer orders are collected from the apparel manufacturing company. Similar customer orders before and after implementation of the software are included in the work.
4. The performance of Time and Action event completion using the conventional method, where excel type spreadsheet application is used, are assessed.
5. Then the performance of Time and Action events completion after the implementation of integrated production planning and control software is assessed.
6. The reason for late event completion is analyzed with the help of the Pareto Diagram and Cause and Effect Diagram.
7. Finally, Time and Action plan performance between the conventional system and integrated production planning and control software-based system is compared.

1.5 Scope of the Thesis

The purpose of the study is to assess the contribution of integrated production planning and control software in improving the TNA plan in the apparel industry. This research will help the manufacturers to decide on the adoption of software in managing TNA activities. This research paper is organized into the following chapters to provide readers with a clear understanding of the topic:

Chapter One introduces the research paper.

Chapter Two includes the theoretical background and literature review.

Chapter Three describes the conventional practice in Time and Action plan.

Chapter Four describes the TNA plan with integrated production planning and control software.

Chapter Five contains the comparison of data to measure improvement in Time and Action plan.

Chapter Six contains the conclusion part of the research report that includes future research work scope recommendations.

CHAPTER 2
LITERATURE REVIEW

2.1 Apparel Industry Business Structure

The readymade garment is a labor-intensive industry and relatively simple technology compared to other high-tech industries. The RMG manufacturing units are like tailor's shop; getting an order from the foreign buyers and then import raw materials especially fabrics from the foreign suppliers or sometimes buy from the local market as per order, then manufacture garments and supply those to the buyers (Munir and Salim, 2000). Nuruzzaman (2009) presented this workflow with a flow chart:

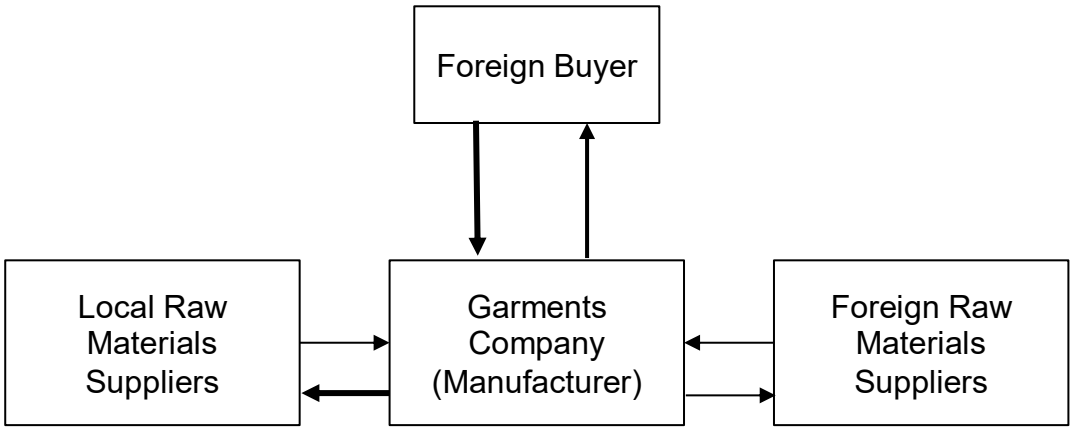

Figure 2.1: Business Structure of Apparel Industries in Bangladesh (Nuruzzaman, 2009)

The manufacturer must complete the whole order within an agreed lead time in the purchase contract. Lead time is one of the leading competitive factors among companies. The ability to deliver quickly influences export, sales and thereby revenue. The definition of lead-time can vary, depending upon what part of the company is focused. It usually includes all activities from start to end. Lead time begins with the first receipt of a customer order and ends with customer receipt of the product or service. Everything in between is the lead-time (elsmar.com, 2004). Lead-time refers to the time lag between placing an order and receiving it (Li, 2000). Apparel merchandisers have to follow a Time and Action plan to procure all the raw materials,

sample approvals, garment production, and finally ensure on-time delivery of finished goods within the lead time.

2.2 Steps in Apparel Business

Apparel manufacturing has a long value chain. Every stage in the value chain adds value in the raw materials, and finally, finished goods (ready-made garment) are produced. Sarkar (2013) described the standard process of apparel manufacturing, starting from the order receiving to the shipment. The garment manufacturing process involved in several processes from order receiving to the shipment of the finished garments. A process flow chart can help to understand how the raw materials are moved from one stage to another stage until the raw materials are transformed into the final product (ready-made garments). It is worth mentioning that garment manufacturing processes can vary based on the manufacturing facility and product types. As some companies do the whole process in a single plant when others do production jobs and other auxiliary processes are outsourced.

Based on the modern apparel industry, garment manufacturing processes can be categorized as:

i. Pre-Production Processes – The activities which are required to be completed before the production starts. The pre-production processes include sampling, sourcing of raw materials, Sample approvals, PP meeting, etc.
ii. Production processes - Production processes are cutting, print, embroidery, sewing, washing, etc.
iii. Post-production processes – When the goods are produced, there are some activities required to be completed to get the goods ready for shipment. The post-production processes include thread trimming, pressing, checking, folding and packing, quality inspection, shipment, etc.

The following Figure 2.2 is a process flow chart of the essential processes of executing a customer order in the garment industry without breaking down to the detailed operations of a manufacturing stage.

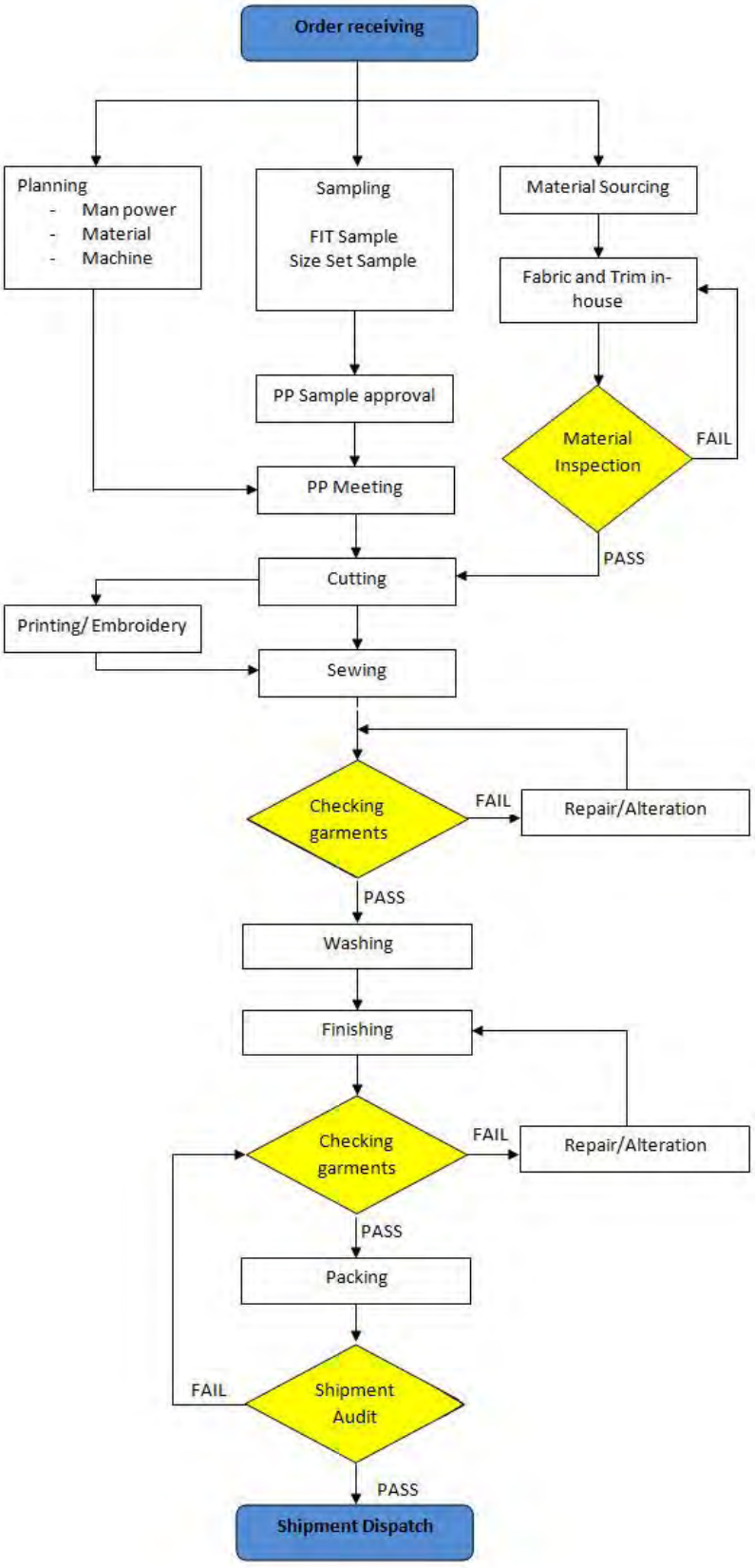

Figure 2.2: Apparel Manufacturing Process Flow (Sarkar, 2013)

In this research, the Time and Action plan of the apparel industry will be focused.

2.3 Time and Action (TNA) Plan

The Time and Action plan (T&A or TNA Plan) is an essential tool for a merchandiser to enlist the different events involved in the process of completing a customer order. These events involved various departments within the company and various people outside the company. The TNA plan/calendar helps the merchandiser to check and balance the entire order execution process. According to Rathinamoorthy and Surjit (2018), the Time and Action plan define the ideal date/time period within which the major activities of an order should occur against a scheduled delivery date.

Cokar (2019) described how TNA plan is an essential element in the workflow of merchandisers. Merchandisers prepare TNA Plan in a spreadsheet listing the key processes in one column and planned dates for the action of each process in another. They will list every product with their expected delivery date for sample approvals, fabrics, trims, cut dates, quality control, packing dates, delivery dates and more, according to the style. The merchandisers will then follow the TNA calendar on a daily basis to keep the order on track. However, this time and action plan is not merely a data entering process; it is more about scientifically working out the activity duration, logically determining the preceding and succeeding activities, and ensuring on-time delivery after fulfilling all the required tasks for order execution.

Time and Action events vary from buyer to buyer, but it always consumes significant time and effort in the whole order execution process. To execute a whole order, lots of works need to be done, including order analysis, costing, fabric and accessories booking, sampling, production of goods, finishing, etc. Raaz (2015) showed the generic time requirement percentage of the total order lead time by different segments which are given in figure 2.3 below:

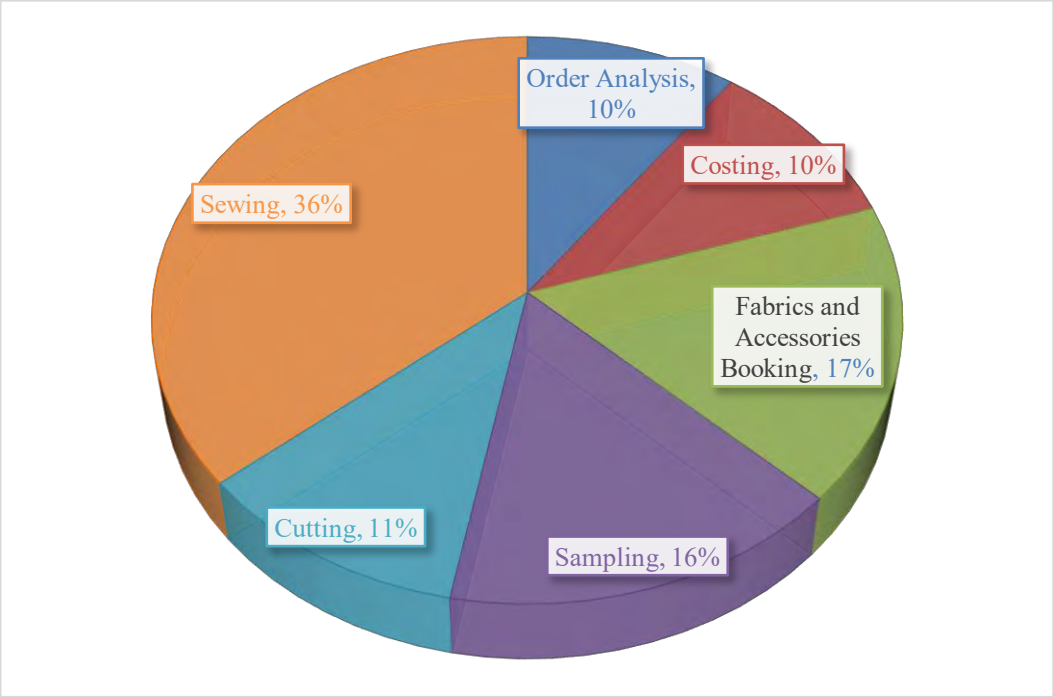

Figure 2.3: Generic time requirement by different stages of order execution (Raaz, 2015)

From this chart, it is evident that production activities are taking less than 50 percent of the total lead time and the rest of the time is spent in various TNA activities like order confirmation, sampling, Raw material sourcing, etc.

2.4 Typical Time and Action Events

Usually, merchandisers prepare a plan of the order in a spreadsheet by listing down the key events/processes in the first column and planned the date of action for each process in the next column. This planning sheet is popularly known as time and action calendar (TNA). Once the TNA calendar is made, then it can be easy for the merchandiser to list down their daily 'to-do list' and taking it one by one. As per the TNA schedule, processes can be executed on a timely basis to track whether an order is on track or it will get delayed. Time and Action activities usually vary from buyer to buyer. Also, the same event can be known in a different name for different buyers. Sarkar (2013) provided a sample Time and Action plan format which is given here in Table 2.1 below:

Table 2.1: Time and Action plan format sample (Sarkar, 2012)

	Key Processes	Planned Start	Planned End	Responsibility
1	Order receipt (Buyer PO)	20-Nov		Merchant
2	Consumption calculation	21-Nov		Pattern master
3	BOM generation	23-Nov		Merchant
4	PO issue for Fabric, trims	24-Nov		Store
5	Size set submission	25-Nov		Merchant
6	Size set Comments	28-Nov		Merchant
7	PP meeting	1-Dec		Merchant
8	Production planning updates and circulation	11-Dec		Production Manager
9	Fabric inhouse	24-Nov	8-Dec	Store
10	Trims Inhouse	24-Nov	3-Dec	Store
11	Pattern Grading	2-Dec	3-Dec	Pattern master
12	Khaka making	2-Dec		
13	Cutting	11-Dec	12-Dec	Cutting incharge
14	Beading/Sequence	16-Dec	19-Dec	Production Manager
15	Embroidery	20-Dec	23-Dec	Production Manager
16	Re-cutting/shaping	23-Dec	26-Dec	Cutting incharge
17	Fabrication/stitching	26-Dec	30-Dec	Production Manager
18	Finishing	31-Dec	3-Jan	Finishing Incharge
19	Packing	2-Jan	6-Jan	Finishing Incharge
20	Inspection	7-Jan		QC
21	Dispatch	8-Jan		Finishing Incharge

Time and Action all the activities encompass from the order confirmation, raw material sourcing, sample preparation to the manufacturing milestones. There are slight variations observed in the names of various activities even sometimes the activity itself varies from buyer to buyer. Kothari (2013) described different Time and Action Events that are very common for most of the apparel brands and retails.

2.4.1 Sampling

Buyers always take a sample from manufacturers to confirm that they are getting the right product. There are three broad classes of samples, one for each phase. These

sequential phases are design, sales, and production. Design related samples are to model design ideas and (ideally) finalize the pattern for production. Sales related samples are used to predict orders from buyers. The last type of sample is intended to test consistency in production. Sampling is the most crucial task for any manufacturer and hence needs to be planned very carefully. Some sampling stages are critical and any deviation or delay in getting approval from the buyer may delay the whole Time and Action timeline. Fasanella (2011) discussed the different types of sample used in the apparel industry in the Fashion-Incubator blog.

2.4.1.1 Muslin sample

Also known as the dummy, mock-up, drape, etc. It is a concept sample, often a rough rendition of a drape sewn together. Used primarily by designers who prefer to convey design ideas in the actual fabric as part of their creation process instead of drawing a sketch. Alternatively, they have an idea but cannot articulate it, so they put fabric to mannequin instead.

2.4.1.2 Fit sample

Also known as First sample, Original sample, Sample test garment, Development sample, Design sample, etc. It is a sample made from the first (or production quality) pattern (which was made from the muslin or mock-up) and intended to test the designer's idea or concept in the chosen fabrication. If the design, fabrication, and fit of this sample come out as planned and do not need corrections, it is approved and becomes the prototype sample.

2.4.1.3 Prototype

Also known as proto sample. This sample is the result of previous iterations, the version that meets the designer's test for execution. The fit should also be as expected, so it would also be a fit sample for companies that use a separate designation. Ideally, a proto sample is also sewn by, as described below. If sewing is in house, the prototype should be used for costing and become the production sew-by.

2.4.1.4 Sew-by

Also known as costing sample etc. This sample reflects all of the desired construction details and is used to solicit contract sewing bids (CM&T). It is called sew by because contractors use this sample to create a costing or pre-production sample. Again, ideally, the prototype sample is also sewn by. Particular care should be taken in designating a sample as a sew-by because for better or worse, the quote will be built on this. If one is producing domestically in house, the prototype sample should be the sew by for in house use to make sales samples. It is in sales sampling that the pattern is proven, and final costs calculated.

2.4.1.5 Pre-production

Also known as pre-pro, P/P sample, counter sample, etc. It is the final sample before production starts. This sampling stage is to prove the pattern, test cost-effectiveness and consistency in production, whether it is done in house or outsourced to a contractor. If the (counter) sample is approved, it will become the production sew by. Ideally, pre-production samples (salesman's samples) are used to pre-sell the product.

2.4.1.6 Sizing sample

Also known as size run and size set. Sample lot production of a style in all the intended sizes. Ideally, all the design sizes are targeted early on in the product development stage. It may not be possible if silhouettes vary significantly between styles, meaning it may require to test sizes of various styles.

2.4.1.7 Top of production

It is also known as Top sample. A top sample is pulled from the first production run (above), which proves the quality of the product which is produced in the actual production environment.

2.4.1.8 Shipment sample

A sample that reflects what buyers will receive down to QC, folding, tagging, bagging, pre-packs (if applicable), labeling and final packaging included.

2.4.2 Pilot-run

Pilot run, also known as a trial production run, is done after approval of PP sample and before bulk cutting. A 'pilot run' for a style (order) is conducted if the buyer asked for it. Many garment manufacturers set pilot-run as standard procedure. In those companies, a Pilot run is a must for all styles irrespective of buyer requirement. Though if the order quantity is tiny, a pilot run does not take place. Manufacturers cut around 100-200 garments per style for the pilot run. This production is done based on PP comments. All 200 pieces are treated as mini production. The factory follows complete processes planned for the order. The factory sets up a stitching line. Furthermore, production for the pilot run is done as it to be done for bulk production. The purpose of the pilot run is to check production techniques and quality requirements. The factory quality department thoroughly checks pilot run pieces at every stage of production. Through the pilot run process, the production team learns about the critical operations in the styles, identify potential bottleneck operations. Based on their learning in the pilot production run, they prepare themselves for bulk production. Just after the pilot run, factory loads bulk production. There are many other benefits to the above such as cross-checking the estimated raw material requirement for fabrics and threads, re-planning of additional processes requirement, maintain minimum WIP in the production line, identifying critical quality checkpoints.

2.4.3 Fabric and Trim sourcing

Fabric is the primary raw material for the finished garment. Trims are auxiliary raw materials like Buttons, Zippers, Velcro, Hangtags, etc. Fabric and trim sourcing is a very time-consuming process that requires various approvals from a buyer like a desk loom and lab-dip approvals, trim and artwork approval, FPT approval, etc. The fabric sourcing itself will take a lead time of 30-60 days depending upon the type of fabric and country of origin. Usually, for yarn-dyed fabric, it takes approx. 45 days, for piece-dyed fabric, it takes approx. 30 days and for fiber dyed fabric, it takes approx. 55-60 days. Lead time could be shorter if the manufacturer has an in-house knitting or weaving facility.

2.4.4 Fabric approvals

With the approval of the proto sample, the merchandiser needs to submit a lab-dip for color confirmation. Lab-dip approval itself is a long process, as the development of shade and submission itself will take 10-15 working days for one attempt, hence after 15 days of proto approval Lab dip is submitted. Hence while preparing the TNA merchandiser must keep in mind that the complexity of shade, buyer's specification, etc. any delay in lab-dip submission will end up with fabric production delays, which will result in delay; Size-set sample submission.

2.4.5 Planned cut date

Planned Cut Date (PCD) is one of the most critical dates in the whole Time and Action. It is a junction point between pre-production and production. Some manufacture maintains an equivalent event named 'File Handover.' In file handover, merchandisers complete all the pre-production activities (order confirmation, raw material sourcing, sample approval, etc.) and provide the order file to the production department to proceed with garment production activities. Most of the time, the TNA plan is prepared by keeping PCD in mind. To hit the PCD target date, the supply chain department plays an important role, as the lead time of trims and fabric production and availability for garment production is controlled by this department. While preparing the TNA, expected lead time and sufficient buffer should be kept for sourcing.

2.4.6 Final inspection

The final inspection consists of inspecting finished garments from the buyer's point of view; size measurements, (putting garments on the proper size manikins to see if they properly fit labeled sizes); and live modeling if necessary (again to see if the garments properly fit the labeled sizes). A final inspection may occur before or after garments are packed in poly bags and cartons. If it is done after garments packed, then proper size and style markings on the package can also be checked. Usually, the AQL method is used in the final inspection. According to ISO (2007), AQL (Acceptable Quality Limit) refers to a system where the acceptability of a lot is implicitly or explicitly determined from an estimate of the percentage of nonconforming items in the process, based on either one or two random samples of items from the lot. In this system, a

sample is selected by a random sampling technique from a lot. After a proper inspection, the decision is taken whether the lot will be accepted or rejected based on the defective item percentage in the lot. This applies to raw materials to finished product inspection as well. This system is widely used in the apparel industries worldwide.

2.4.7 Ex-factory/Shipment

The final stage of the order. After the good is produced, it is dispatched to port or shipped to the customer warehouse, depending on the contract.

2.5 Role of Merchandisers in Time and Action Plan

Merchandisers are people who merchandise the goods, specifically for export purposes. There are many definitions of merchandising in print and probably dozens more in use in everyday practice, particularly in the apparel industries. Perhaps the most confusing practice is using retailing and merchandising interchangeably. Retailing is selling goods and services to be the ultimate consumer. Retailing is one component of the consumer goods trade matrix. The trade of matrix for apparel includes four significant components material manufacturers and suppliers, finished goods manufacturers, retailers, and consumers. In contrast, merchandising is one of several functions required to run a business that might operate at any level of trade channel. Kothari (2015) listed down the key roles played by merchandisers as planning for merchandise, vendor and production management, liaison between buyer and manufacturer etc. They continue to play an essential role in the exchange process by providing products for consumption. Merchandiser must still understand customer demands, analyze sales trends, and select and present salable products. Merchandising is the analyze and response to the changes and processes which occur in the planning, negotiation, acquisition, manufacturing and selling products/service from their inspection to reception and use by the target customer. (Thavanayagam et al., 2010).

2.6 Requirements for Preparing A TNA Plan

The purpose of time and action plan is to cross-check each event related to a particular order regularly. It makes sure that all the stakeholders of an order are on the same page and corrective actions can be quickly taken if anything goes south. After the preparation of the TNA calendar, a merchandiser can list down daily *TO DO* list and work with it one by one. As per the TNA schedule, processes can be executed on a timely basis and responsibilities can be tracked down at the event level. Rathinamoorthy and Surjit (2018) highlighted what factors merchandiser need to consider to prepare a time and action plan:

- Extensive process flow of an order from the sampling to dispatch with tasks to be performed on each activity.
- The detailed production capacity of various departments of their unit. In some cases, the merchandiser needs to know their vendor's production capacity also.
- Tentative lead time details of various raw material and buffer time required for each department.
- Style complications in each department level, both in technical aspects and also in terms of throughput time of different departments.
- Duration of transportation, shipment and logistics facility for the particular customer and exact delivery date to the customer.
- Availability of the exclusive machines/technology and their possible influences.
- Details regarding the local and national level holidays – in his/ her company and also holiday information about customers/vendors, from where the raw material imported or to whom the products need to be delivered.
- Complications associated with the sourcing and manufacturing of trims and accessories.
- Government and political policies of concerned countries.
- Response time of customer/buyer at various stages.

2.7 Importance of Time and Action Plan

Major role of the TNA plan is to ensure the on-time delivery of the goods by fulfilling the whole process from the order confirmation stage to the goods ex-factory. Kothari (2013) pointed out the importance of proper management of TNA activities as follows:

i. A proper time & action plan can help to streamline the pre-production activities.
ii. Easy understanding of order processing requirements and define responsibility matrix.
iii. It provides a clear understanding of the time-phased requirement of events based on the lead time given by the buyer.
iv. It gives a clear idea about the minor or sub-activities that need to perform during order processing at different levels.
v. Gives the idea about the status of running order and provides information about expected delay or deviation (if any).
vi. Gives the dates at which raw materials need to be sourced in a way it helps to optimize the inventory.
vii. It reduces the risk of a delivery delay of finished goods to the customer.

2.8 KPI to measure Time and Action Performance

KPI (Key Performance Indicator) is a general term used in any industry. A performance indicator or key performance indicator (KPI) is a type of performance measurement. KPIs evaluate the success of an organization or of a particular activity (such as projects, programs, products, and other initiatives) in which it engages (Fitz-Gibbon, 1990).

Time and Action Hit Rate or, simply *TNA Hit Rate* is the most common KPI measured in evaluating the performance of the TNA activities of the garment industry. The hit rate is a metric or measure of business performance traditionally associated with sales. It is defined as the number of sales of a product divided by the number of customers who go online, call, or visit a company to find out about the product (Cambridge Online Dictionary, 2019). This measure is also standard in measuring the KPI of the merchandisers in the garment industry. It implies the number of events completed on time against the total number of events. The formula can be described as below:

$$\text{TNA Hit Rate} = \frac{\text{No. of Events Completed on time}}{\text{Total Events Completed}}$$

For Example: if there are 50 events in total and out of those, 30 events are completed on-time, then the TNA Hit Rate will be = 30/50 = 0.75 = 60.00 %.

2.9 Pareto and Cause and Effect Diagram to Determine Problem Root Causes

Pareto Diagram or Pareto Analysis is a technique that helps to identify the top portion of causes that need to be addressed to resolve most problems. It is common to refer to Pareto as an "80/20" rule, under the assumption that, in all situations, 20% of causes determine 80% of problems, this ratio is merely a convenient rule of thumb and is not nor should it be considered an immutable law of nature. Juran (in 1940) applied Pareto analysis for separating the “vital few” from the “trivial many.” In another case study in the foundry industry by Perzyk (2007), Pareto chart shows that the defects like ’sand inclusions’ and ‘gas holes’, make up 72% of all defects. Pareto diagrams can, therefore, be particularly useful in determining the vital reasons for any problem. Pareto charts show the most frequently occurring factors and help to make the best use of limited resources by pointing at the most important problems to tackle.

Cause and Effect diagrams (also called Ishikawa diagrams) is a visualization tool for categorizing the potential causes of a problem in order to identify its root causes. It is widely used to evaluate the business process and its effectiveness. It is also known as a fishbone diagram because of its structural outlook and appearance (Bose, 2012). Cause and effect diagrams can be particularly useful when ‘vital few’ reasons for a problem are already identified by Pareto analysis. Then it can be used to determine the root causes of that ‘vital few’ reasons. Chandna and Chandra (2009) studied forging operations that produce crankshafts used in trucks and buses. With the help of Pareto diagrams, critical areas are identified, and forging defects of crankshaft have been prioritized by arranging them in decreasing order of importance. Then Cause-and-Effect Diagram (CED) is applied to explore possible causes of defects through a brainstorming session and to determine the causes, which have the most significant effect. The corrective measures reduce the rejection rate from 2.43% to 0.21%.

2.10 Expected Benefits of System Implementation

The researchers widely discuss the expected benefits of implementing an ERP or other software systems. Sundar and Krishna (2013) found that ERP systems contribute to simplification, standardization, integration and automation of processes, and these improvements lead to enhanced agility for the business. Botta-Genoulaz and Millet (2005) found that companies that implemented an ERP system experienced improved performance in terms of information accessibility and integration across the organization. They also found some lesser improvements in financial flows, control, lead-time control, cost control and inventory control, and the unexpected benefit of clarification of the organization.

Many of the proposed benefits of software solutions are based on improved coordination between the departments within the organization and improved information flows. However, Gattiker & Goodhue (2004) suggest that depending upon the amount of interdependence and differentiation among sub-units of an organization, ERP systems may ‘‘fit’’ some organizations better than others.

The benefits of using a software solution to manage different operations of an organization are summarized by Waters and Waters (2013), which is given in table 2.2.

Table 2.2: Five major category of benefits of using software solution

Sl.	System Benefits	Definition
1	Operational benefits	The operational benefits are those arising from automating cross-functional processes.
2	Managerial benefits	This includes benefits that arise from the use of data to better plan and manage production, workforce, inventory and physical resources and from the monitoring and control of the financial performance of products, customers, business lines and geographic areas.
3	Strategic benefits	This category focuses on the benefits that arise from the system's ability to support business growth.
4	IT infrastructure benefits	This consists of the typical IT department benefits arising from the reduction in the cost of maintaining legacy systems.
5	Organizational benefits	This category captures the benefits derived from the facilitation of business learning, empowerment of staff and higher employee morale and satisfaction.

CHAPTER 3
CONVENTIONAL TIME AND ACTION PLAN

3.1 Existing Time and Action Practice

The selected company is a Knit garment manufacturer and exporter to the American and European markets. The major Customers of them include ShopDirect, Cotton On, Burton, Country Road, Dunnes, Esprit. Different merchandising team is responsible for the majority of the Time and Action (TNA) events of different customer accounts. Other departments are responsible for different TNA events throughout the supply chain, such as the Commercial department is responsible for sourcing raw materials, Store is responsible for managing the inventory, the Planning team does the production plan, Production team does the production. Time and action include various events that are related to the function of these teams. Merchandising team is ultimately responsible for follow-up and manage all the events for their respective customer account by doing liaison with different teams of the company. The progress of TNA events of all the running purchase orders is tracked on separate spreadsheets. A weekly TNA synchronization meeting is held where the latest updates are discussed by the respective departments and based on the updated situation, an action plan is agreed. Besides, a lot of emails and phone calls are also used to get and share TNA events update.

After discussion with the merchandising and planning team, the TNA framework defined as follows in table 3.1:

Table 3.1: Time and Action Framework for Cotton On customer

Sl.	Events	Relative to Event	Offset Days	Responsible Dept.
1	Order Confirmation	Delivery Date	-90	Merchandising
2	Fabric booking	Order Confirmation	3	Merchandising
3	Yarn in house	Fabric booking	5	Store
4	Print submission	Order Confirmation	10	Merchandising
5	Knitting complete	Fabric booking	10	Production
6	Trims booking	Order Confirmation	15	Merchandising
7	Lab Dip submission	Order Confirmation	17	Merchandising
8	Fabric submission	Fabric booking	15	Merchandising
9	Print approval	Grade Sample Submission	-5	Merchandising
10	Fabric approval	Fabric submission	5	Merchandising
11	Lab Dip approval	Lab Dip submission	7	Merchandising
12	Grade Sample Submission	Fabric approval	5	Merchandising
13	Grade Sample comments	Grade Sample Submission	5	Merchandising
14	Trims in house	File Handover	-10	Store
15	Fabric in house	File Handover	-7	Store
16	File Handover	Delivery Date	-35	Merchandising

3.2 Limitations of Conventional TNA Plan

Maintaining a Time and Action plan using a spreadsheet is cumbersome. Because it involves contributions from hundreds of personnel from different departments. Below are the common problems faced:

1. In the Apparel business, all the departments are interlinked; each department is dependent on others for accomplishing their tasks. Figure 3.3 shows the internal supply chain in the apparel industry and represents how every department is connected to other internal departments and even to outside parties.

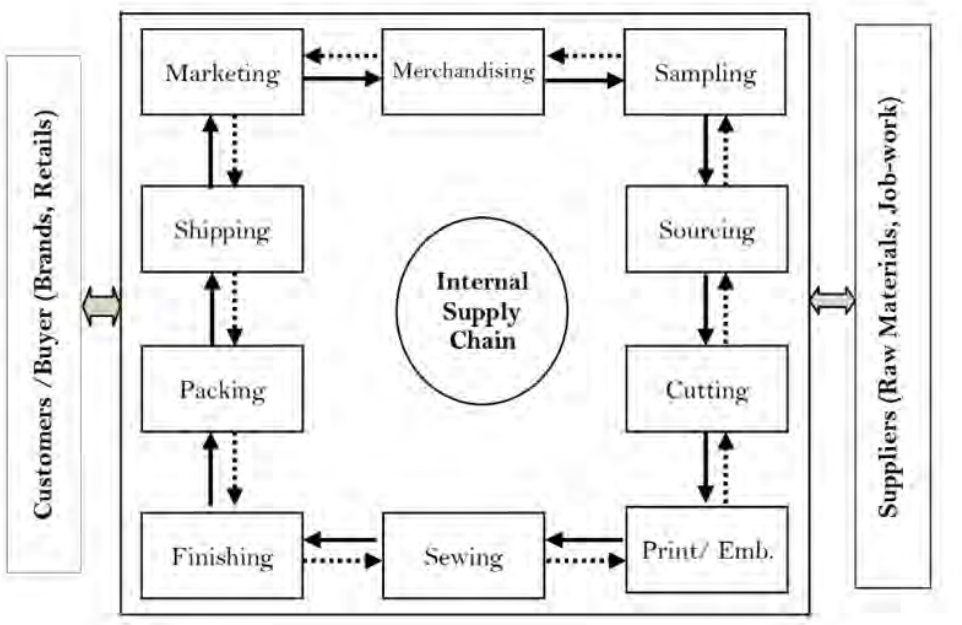

Figure 3.3: Internal supply chain in the apparel industry (Sarkar, 2015)

In a conventional environment, everyone is following their own spreadsheets; there is no connection between teams. This communication gap results in production downtime. For example, the fabric is supposed to arrive on a date and planning team made based on that expected arrival date. However, for some reason, it did not arrive on-time. Merchandiser updated that information on his spreadsheet, but planning personnel was not aware of that change. Hence, he did not revise the plan. As a result, the plan failed, and the production floor faced downtime to accommodate the last-minute change.

2. Every merchandiser has to track and follow a vast number of events daily. Without a proper visual management system, it is difficult to manage these lots of tasks. As a result, there remains a chance of event failure.
3. Time and Action updates are maintained on discrete spreadsheets. Hence, repetitive meetings, phone calls, emails are required to bring different teams on the same page. It incurs the waste of valuable staff-hours.

4. Time and Action updates are maintained on discrete spreadsheets. Hence, the preparation of any reconciliation report takes a long time, sometimes even impossible.
5. The reasons for event failure are not recorded correctly. Hence, analysis to determine the root cause and eliminate the causes does not become possible.
6. KPIs are difficult to measure as the whole Time and Action plan is manual, and data integrity is not there.

Furthermore, in a conventional method, TNA target dates are set based on the delivery date with a fixed period assumed for the production. Figure 3.1 represents an example of how the total lead time of 90 days is distributed for different segments of time and action plan.

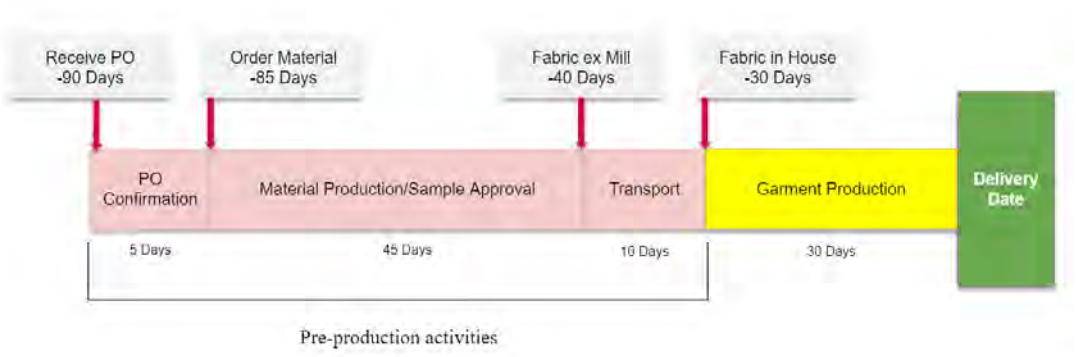

Figure 3.1: Major segments of the lead time of an Apparel manufacturing order

However, this approach is much too simple and does not work effectively. Here is why that is:

- Most of the time, the manufacturer has many orders with the same delivery date, i.e., at the middle and end of each month. It is because the buyers often work in these time 'buckets' and want to consolidate shipments to save transport costs.
- Using the above method, if 30 orders each have the same delivery date, then those 30 orders will all have the same target dates for each activity (assuming

similar product types), but of course, it is impossible to complete 30 samples, or order/receives 30 lots of fabric or trims on the same day.

- It means that there is no clear priority for these 30 orders so that each department will set their own priorities and that priority will never be the same across all departments and suppliers.
- The result is when a garment manufacturer plans to start production of certain orders, requirements are not coordinated and activities are likely to be completed for some orders and ready for production, but others will not be.

Moreover, in practice, it is not always required 30 days for every production order. The time required varies according to several factors, such as the style detail, order quantity, available capacity.

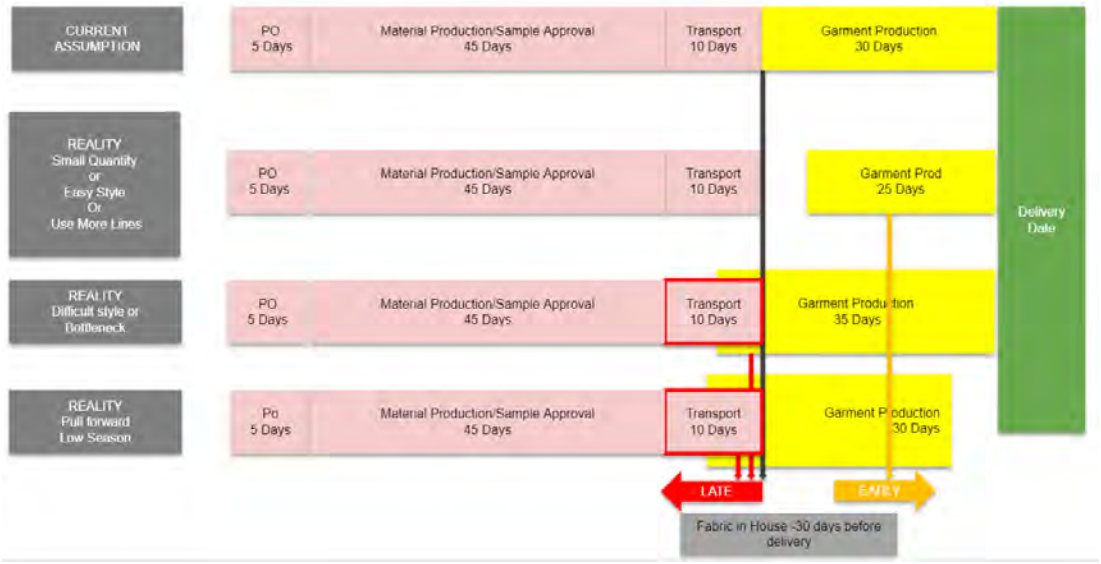

Figure 3.2: Variations of TNA requirement based on Style, Volume and Capacity

In the example given in Figure 3.2, we can see 4 different orders, all with the same delivery date. However, in reality, they will all have different Time and Action targets. In order to get clear priorities for each order, some vital factors need to be considered:

- The delivery date is not the key driver for most activities. Consider the relationship between the pre-production activity, the production process, and the delivery date. For example, the fabric is not related to the delivery date; it is related to the start cut date (Cutting production start date).

- Production start dates are typically the key driver. The start date for each order will depend on many factors, such as:
    - Styling, i.e., SAM or SMV
    - Order quantity
    - Capacity available, including how many sewing lines will be used
    - Seasonal demand between high and low season, i.e., are we pulling forward some orders to smooth capacity loading.
    - Production processes required and their constraints, i.e., are embroidery or washing required? Will they be in-house or subcontracted?
- This technique of setting priorities based on actual demand (required start dates) is often referred to as the PULL system or JIT (Just in Time) in Lean terminology.

This rule is difficult to follow without an integrated software solution because maintaining real-time collaboration within various departments is almost impossible. However, integrated production planning and control software can quickly bring all the players under the same hood.

Besides, conventionally, as the target date of events is set based on the delivery date or order confirmation date. It has no connection with the production plan. Hence, sometimes raw materials are imported well in advance then the actual requirement based on the production plan — this unnecessary holding of stock results in the capital lock.

Above mentioned limitations of the conventional TNA plan lead to delays in completing the events that result in increased pre-production lead time and shrink the production lead time. To accomplish production within a shorter lead time requires added over time or sub-contract. Sometimes it even results in air shipment. All these increase manufacturing costs and ultimately cuts the profit margin.

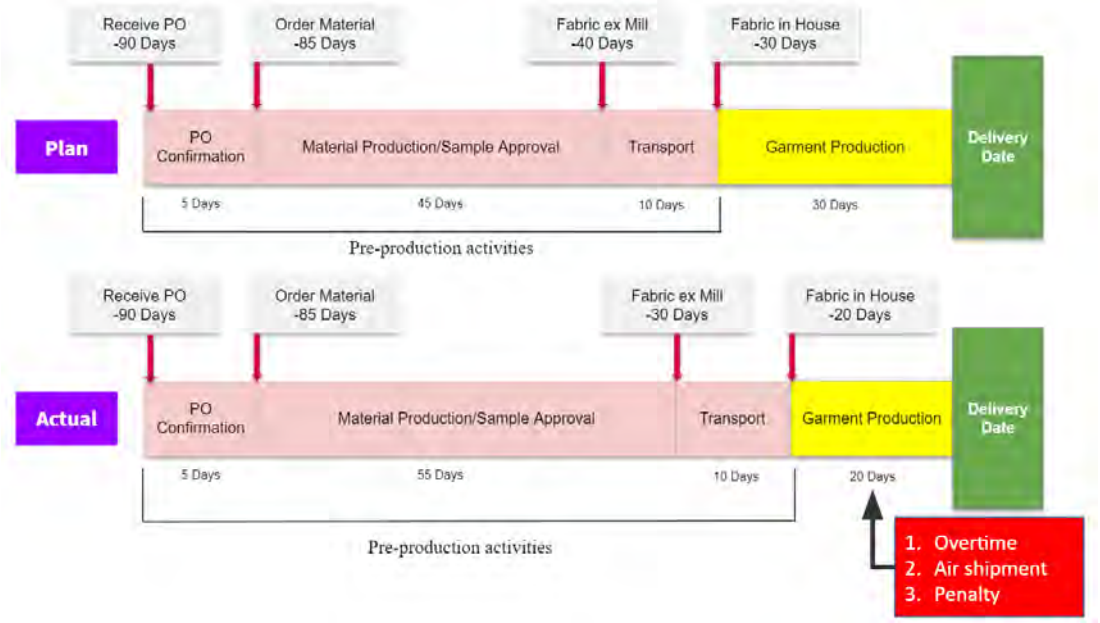

Figure 3.4: Delay in TNA events in pre-production shrinks available production lead time

An example presented in Figure 3.4, the given lead time is 90 days in total, of which 60 days will be used for pre-production activities of Time and Action plan, and the rest of the 30 days are reserved for production. If preproduction activities are delayed and take 10 days more, then only 20 days are left for completing production.

The final result of a poor TNA plan is many which include late delivery, profit loss due to excessive overtime, discount etc. Sarkar (2011) listed down the five primary reasons that fail production plan and the cause of the shipment delay. The first two of those reasons i.e. Product development and sampling and Delay in the sourcing of raw material, are a direct result of poor TNA plan. Due to these reasons, it is challenging to maintain the Time and Action plan in a spreadsheet in the conventional method. Hence, integrated software solutions come into place.

CHAPTER 4
TIME AND ACTION PLAN USING PPC SOFTWARE

4.1 Integrated Production Planning and Control Software

In the previous chapter, it was discussed how difficult it could be to maintain a good Time and Action plan in the conventional method. That is why various integrated production planning and control software are developed to overcome the limitations of a conventional technique. These software solutions are being used both in Bangladesh and abroad in production planning and control of the apparel business in recent years. There are several solutions such as SAP, Oracle, WFX, Accellar, Dynamics AX, FastReact, Algorithm. Various apparel manufacturing companies across the globe widely adopt these software solutions. Global fashion brands, high street retailers and prominent worldwide manufacturers all use production planning and control software to improve visibility, efficiency, coordination, and control.

These tools help businesses to improve in the following areas:

- Making a realistic plan, quickly: With quick and accurate information, the right decisions and realistic commitments can be made. Dynamic solution means that the production plans and all associated priorities are updated continuously. It allows seeing challenges early and adapts accordingly. The result is increased capacity and factory efficiency.
- Control pre-production and materials: Integrated solutions can bring capacity, TNA and materials availability data into a single system. It removes enormous amounts of manual process and drives clear priorities, ensuring pre-production approvals, materials and trims are always available at the right time.
- Eradicate late deliveries: Contribute in reducing late deliveries in the following ways:
    - Help to make realistic commitments, empowered by more informed and up to date information.
    - Work to clear, coordinated priorities, to improve on-time production start.

- Provide regular updates and early warnings so that one can adapt to the latest situation.

The main essence of any production planning and control software is to provide the best chance to make the best plan, execute timely and with minimal wastage and maximize profit.

4.2 TNA Plan using Integrated Production Planning and Control Software

Implementation of Time and Action plan using production planning and control software involves five key steps. These steps are discussed below:

4.2.1 Step 1. Define the activities and persons responsible

A Time and Action Events framework is defined in the master database. It includes all events and the rule for calculating when it should happen. For example, Fabric needs to be ordered 3 days after Buyer PO is received Fabric Receipt is required in house 5 days before the first cut date. In this way, all possible required events will be added to develop a complete TNA framework as below Figure 4.1:

Event name	Relative	Offset
010 Order Confirmation	First order delivery date	-90
020 Fabric Booking	Order Confirmation	3
030 Yarn in house	Fabric Booking	5
040 Print Submission	Order Confirmation	10
045 Lab Dip Submission	Order Confirmation	17
050 Knitting Complete	Fabric Booking	10
050 Lab Dip Approve	Lab Dip Submission	7
055 Fabric submission	Fabric Booking	15
065 Print Approval	Grade Sample Submit	-5
070 Fabric Approval	Fabric submission	5
070 Trims Booking	Order Confirmation	15
080 Trims in house	File Handover	-10
090 Grade Sample Submit	Fabric Approval	5
100 Grade Sample Comments	Grade Sample Submit	33
110 Fabric In-house	File Handover	-7
140 File Handover	First order delivery date	-35

Figure 4.1: A sample Time and Action plan in PPC software

In the Apparel industry, time and action requirements and lead time vary widely from customer to customer and style to style. Also, the event responsible person will not be the same for all customer accounts. Hence, one TNA framework will not work for all customer orders. To overcome this, from the master database different TNA templates are then created to select the appropriate events, lead times and person responsible for the different activities in each case.

Templates typically vary by:

- Buyer and product type
- 'New' or 'Repeat' order
- The standard lead time or quick response order

Each new design and order is allocated to the appropriate template as it is entered into the solution.

Further customization can be done on a specific design/order level to cope with exceptional cases that do not fit with the standard templates.

4.2.2 Step 2. Set targets and priorities for each event

It was discussed in the earlier chapter how, in a conventional method, companies choose to use a too simplistic format to target setting (delivery date, minus 30 days for production minus required lead time for each event) to avoid the complexity of target calculation based on production plan. They then must constantly firefight and manage the exceptions to try to achieve on-time production start and delivery.

The software has an integrated production planning and pre-production (TNA) module; it is much easier to generate Time and Action plan based on the production plan, as shown in Figure 4.2.

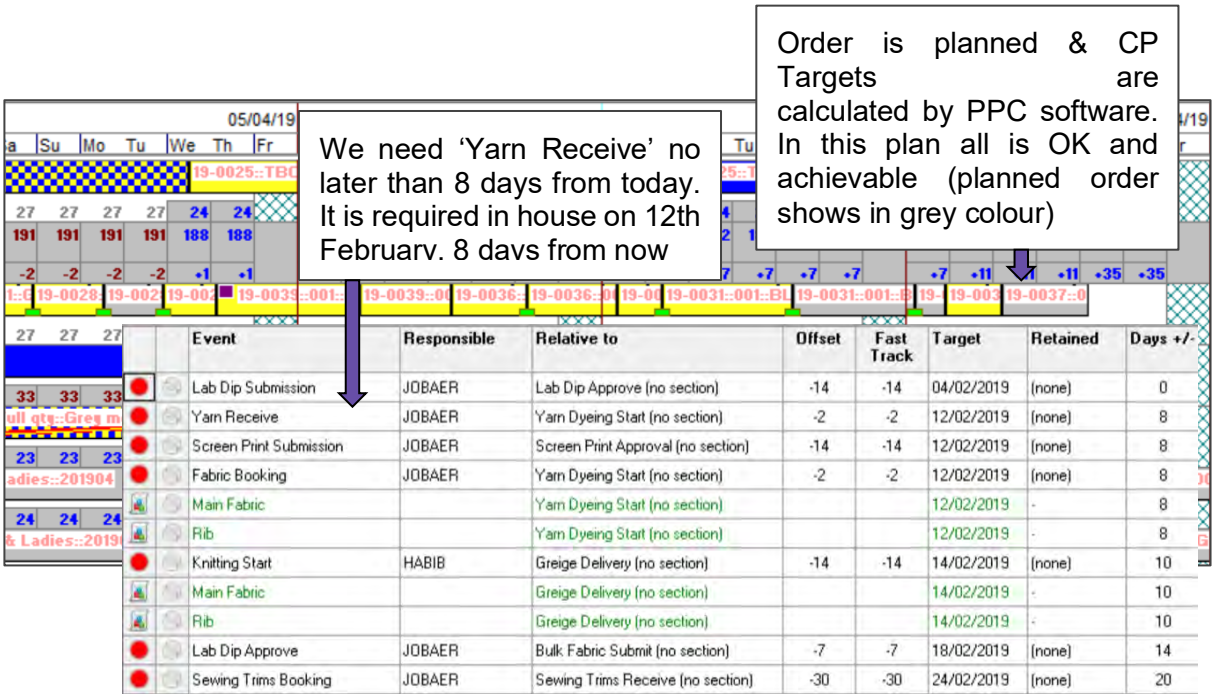

Figure 4.2: Time and Action target dates calculated based on the production plan

Anytime the planner changes the plan, all the Time and Action target dates will be updated as those are directly linked with the plan. Hence, Time and Action events responsible person will get the latest priorities always. Figure 4.3 shows a situation where one order is pulled forward and the system dynamically changed its color into yellow to warn there is a TNA issue.

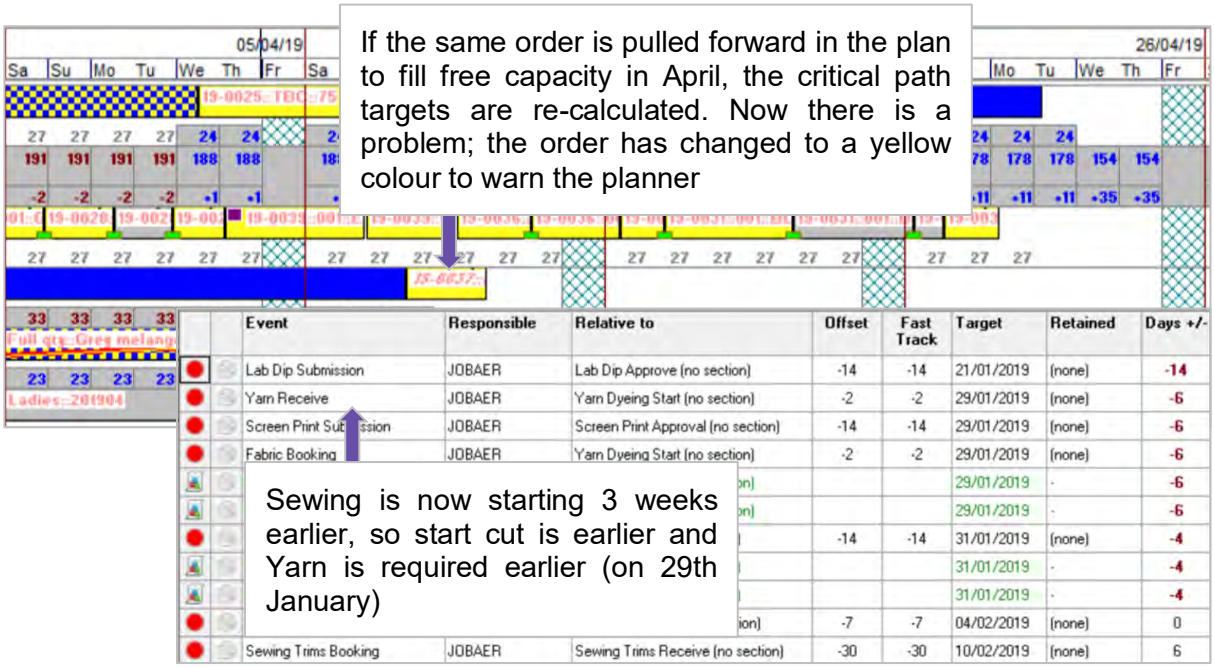

Figure 4.3: Time and Action target dates are changed as soon as the production plan is revised

4.2.3 Step 3. Monitor and update task status daily

Once clear targets have been established, these need to be communicated to the different people responsible. The interactive pre-production planning board allows staff responsible for TNA to see what is outstanding quickly, update the status, add notes, inform any expected delay in advance, etc. all in one system.

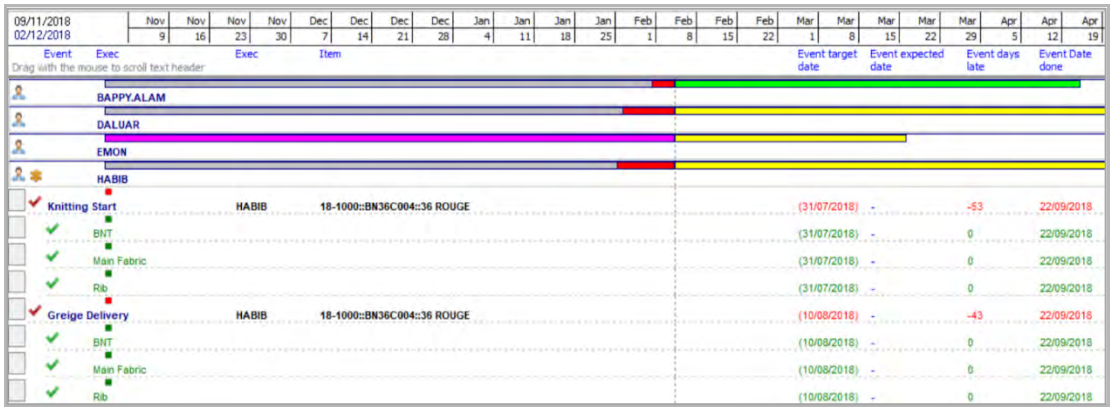

Figure 4.4: TNA Planning Board shows events status with the different color codification

Figure 4.4 shows how the system will show outstanding jobs for each person with the target date and the days left until it must be completed. The red and pink color indicates late, green not yet due and yellow color means any expected delay.

Updates on what has been completed can be made with just a few mouse clicks (events can also be imported from other systems if appropriate). If requested targets are not achievable, an advanced warning can be communicated by entering expected completion dates. Clear priorities can be sent out to all the responsible person as a system-generated report via automatic emails. Figure 4.5 shows an example of such report:

Executive	Buyer	SSL	PO	Color	Event name	Plan Target	Agreed Date	Expected Date	Days Late	Event notes
SUJON	Shop Direct	19-0020	214327/1	Red Cami	Finishing Trims Receive	30/01/19	15/02/19	-	-5	
SHOHAG	Shop Direct	18-1010	156081/1+15	Grey Skater Skirt	Size Set Approve	31/01/19	18/11/18	-	-4	
AKHLAS	Jomo Fashion	18-1454	Full Qty	Black	Sewing Trims Booking	31/01/19	01/02/19	04/02/19	-4	
JIKU	Shop Direct	19-0052	163065/3+16	White Polo	Yarn Receive	31/01/19	-	24/01/19	-4	
AKHLAS	Jomo Fashion	18-1454	Full Qty	Navy	Sewing Trims Booking	01/02/19	02/02/19	04/02/19	-3	
AKHLAS	Shop Direct	19-0081	239521/1	Grey Marl	Sewing Trims Booking	01/02/19	-	-	-3	
AKHLAS	Shop Direct	18-1011	156149/2+15	Black Pinafore	Packing Trims Booking	02/02/19	21/11/18	-	-2	
SHOHAG	Shop Direct	19-0020	214327/1	Red Cami	File Received	02/02/19	01/02/19	-	-2	
HABIB	Shop Direct	19-0043	223177/1	White Polo	Knitting Start	02/02/19	02/02/19	-	-2	
HABIB	Shop Direct	19-0043	223185/1	Dark Navy Polo	Knitting Start	02/02/19	02/02/19	-	-2	
SUJON	Shop Direct	18-1107	147426/2	Pink Tee (cvc)	Packing Trims Receive	02/02/19	01/02/19	-	-2	
HABIB	Shop Direct	19-0052	163065/3+16	White Polo	Knitting Start	02/02/19	-	-	-2	
SUJON	Shop Direct	18-1371	197150/1	Black Tee	Packing Trims Receive	03/02/19	21/01/19	-	-1	
SUJON	Shop Direct	18-1371	197150/1	Peach Aop Bottom	Packing Trims Receive	03/02/19	23/01/19	-	-1	
DALUAR	Shop Direct	19-0020	214327/1	Navy Cami	Bulk Fabric In-house	03/02/19	24/01/19	24/01/19	-1	
AKHLAS	Shop Direct	19-0081	239521/1	Khaki	Sewing Trims Booking	03/02/19	-	-	-1	
AKHLAS	Shop Direct	19-0081	239521/1	White	Sewing Trims Booking	03/02/19	-	-	-1	
AKHLAS	Shop Direct	18-1011	156128/2+15	Grey Pinafore	Packing Trims Booking	04/02/19	23/11/18	-	0	

Figure 4.5: Software generated task list for each event responsible

Some TNA events are the responsibility of people outside the business, such as - suppliers, buyers, and subcontractors. Priorities can be sent out to these people by automatic emailing using the same.

Managers can get a quick overview of the status by event, person, order, buyer, etc. The following Figure 4.6 is an example that shows the screen view sorted to show an overview of the status of each activity/event:

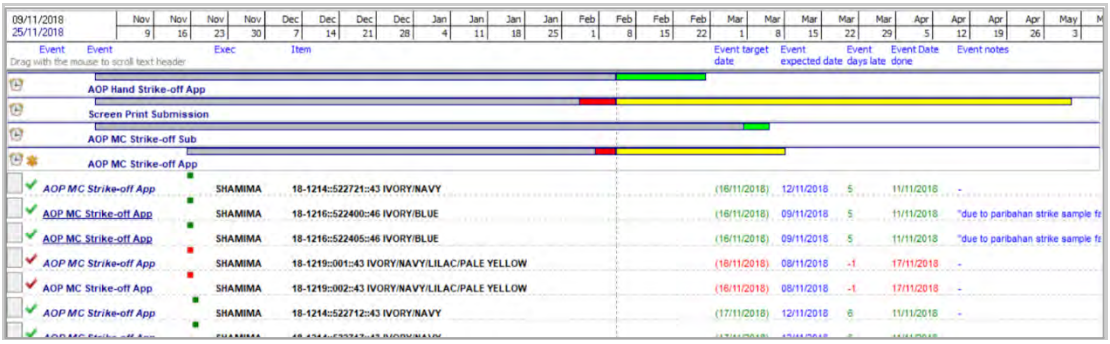

Figure 4.6: Using different sorting method to see event wise status

It is possible to drill down to the details of which style, order & notes if required. As described earlier, Green represents jobs are in control, grey means already completed tasks, Red shows some delays and yellow represents some expected delays (i.e., the target is not achievable, and an expected completion date has been entered that is later than the plan).

As soon as the responsible person update the latest status of the event on the system, it is instantaneously communicated with all the stakeholders. It provides them to set their next course of action which is completely aligned with the other department as everyone is using the software as a single source of information.

4.2.4 Step 4. Manage the exceptions, fast track & re-plan

Because the status of each event is visible, the planner can report and manage the exceptions. If the above steps are carried out effectively, then it is reasonable to assume that the 80/20 rule will apply, i.e., 80% of activities will be ok, but 20% will still raise issues. In so many businesses, TNA status is not visible to the planner; as such, they are often planning 'blind' with no visibility or advanced warning of problems in pre-production. In an integrated system, the TNA status is not only shown on the pre-production planning board but also simultaneously reflected in the production planning board. It allows the planners to see the status and re-plan where TNA problems are faced, so coordination and cooperation between departments are made much more straightforward.

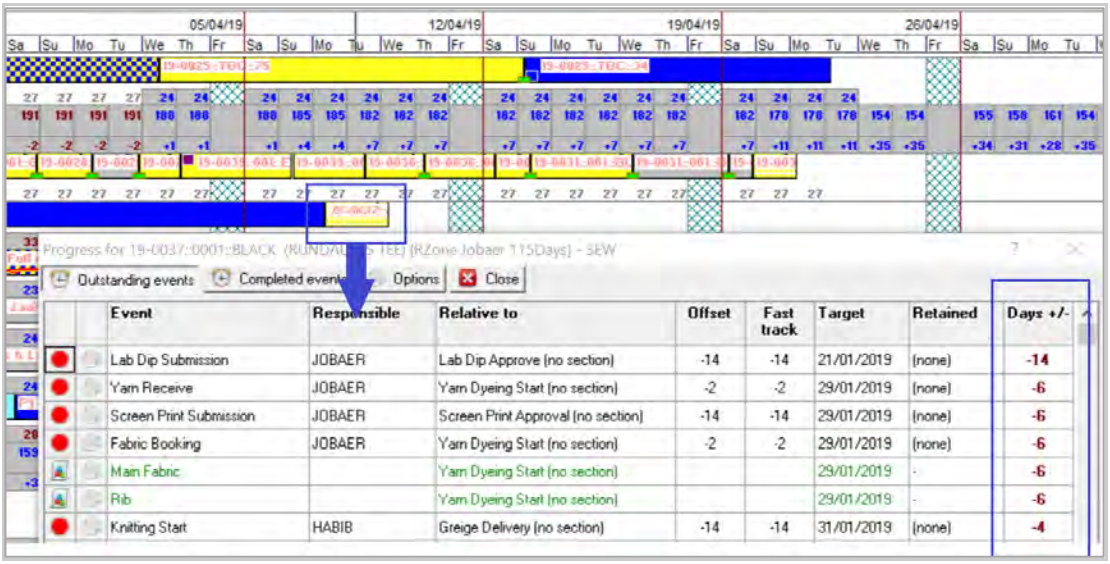

Figure 4.7: Warnings from TNA activities are reflected in the planning board

From figure 4.7, it is understood how the system changes the strip color to Yellow indicating there are issues with one or more Time and Action events. By drilling down a bit, the planner can check what is the problem precisely. Then in figure 4.11, it is shown, if the planner pushes the order back up to two weeks, the yellow color is gone, indicating the problems faced earlier with Time and Action events are now does not exist anymore in the new plan. Moreover, the grey color indicates the order can still be on time for delivery.

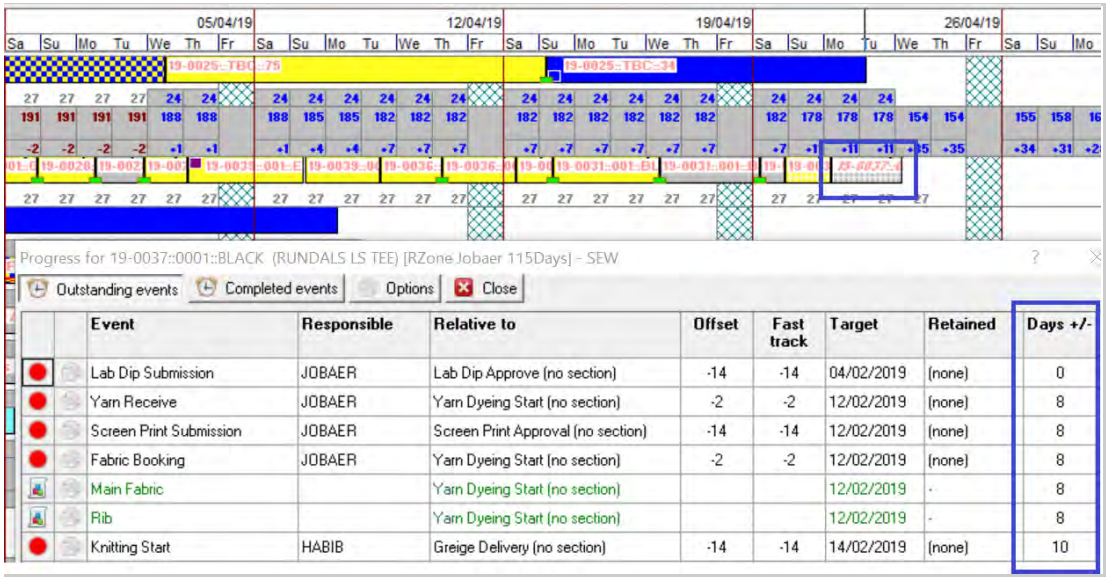

Figure 4.8: After the plan change now TNA issues are resolved

Thus, integrated production planning and control software connects the departments and resolve issues that arose from the communication gap between departments.

4.2.5 Step 5. Measure performance KPI & Continuous Improvement

As with any crucial part of the business process, actual Time and Action performance should be recorded and reviewed. It enables the company to check that the timelines are realistic and identify where and how to reduce them. A full record of the TNA history on all styles and orders is maintained, all data is stored in the database so it can be easily accessed, summarized and filtered.

'TNA Hit Rate' is the primary KPI to measure Time and Action performance. The software generates a TNA Hit Rate report based on the user of the update put on the system. Figure 4.9 is a screenshot of that report:

Event executive	No. of Event Completed	Completed On-time	Completed Late	Late %	On-time %
Event executive Subtotal for Event completed date : 01/02/2019					
SAJIB	13	12	1	8 %	92 %
TOUHID	99	96	3	3 %	97 %
AREFIN	18	16	2	11 %	89 %
ARIF HASAN	33	33	-	- %	100 %
BAPPI	41	37	4	10 %	90 %
BAPPY.ALAM	8	4	4	50 %	50 %
HABIB	209	167	42	20 %	80 %
ISMAIL	76	72	4	5 %	95 %
JIKU	40	38	2	5 %	95 %
JOBAER	43	29	14	33 %	67 %
NAZMUL	199	190	9	5 %	95 %
SAJAL	64	64	-	- %	100 %
SHOHAG	23	15	8	35 %	65 %
AKHLAS	94	94	-	- %	100 %
ALAMGIR	40	40	-	- %	100 %
DALUAR	77	69	8	10 %	90 %
EMON	160	135	25	16 %	84 %
SHAMIMA	355	248	107	30 %	70 %
SUJON	272	142	130	48 %	52 %

Figure 4.9: TNA Hit Rate Report

TNA hit rate can be generated not only for responsible persons but also for department wise, team lead wise, customer account wise TNA hit rate can also be generated.

Besides, the statistics of completed events can also be generated from the system.

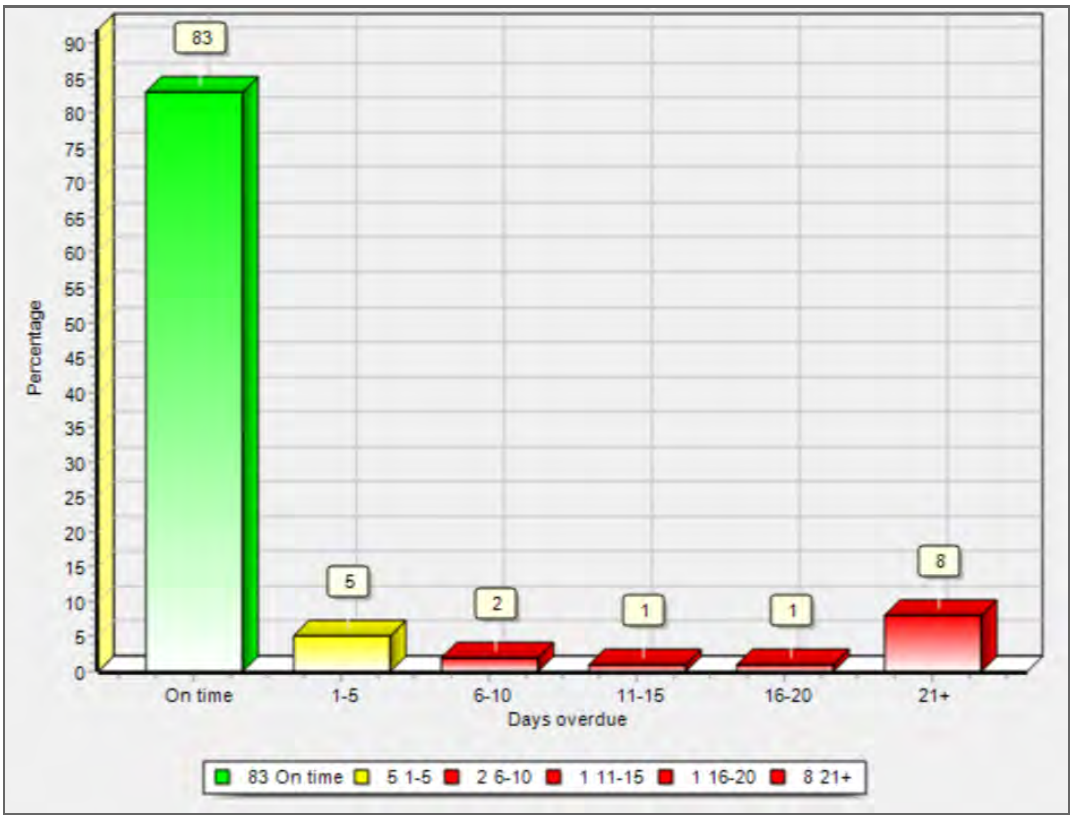

Figure 4.10: Statistics of completed events

This chart given in figure 4.10 divides the number of completed events into segments of days late.

Typically, fashion businesses have little time to review what has happened. As soon as one season is over, they rush into the next. The time-consuming process of collecting and the history of a season is almost impossible for most businesses when the information is somewhere in thousands of emails and spreadsheets. However, as production planning and control software stores data digitally into electronic database tables, it can easily offer much data which, if used correctly, can be the basis for continuous improvement. Event delay analysis is an excellent example of this. When an event is delayed, the person responsible must tell the system the reason for the failure. Then at the end of the season, an analysis report is generated from the system showing the most frequent reasons liable for the failure of events.

Month	Failure Reason	Fequency
30/09/18	Bulk Fabric Approve : Shade reject "Shade not matched with approved lab dip."	1
30/09/18	PP Approval : PP Sample reject ""	2
30/09/18	-	3
30/11/18	Bulk Fabric Approve : Fabric Quality Reject ""	5
30/11/18	Bulk Fabric Approve : Shade reject ""	2
30/11/18	Bulk Fabric Approve : Shade reject "Due to fabric quality issue bulk shade rejected on 30.10.18"	1
30/11/18	Bulk Fabric Submit : Fabric Quality Reject ""	3
30/11/18	PP Approval : PP Sample reject "Due to rib shadding issue for top - 20.11.18"	2
30/11/18	Bulk Fabric Approve : Shade reject "Due to rib shading issue bulk fabrics not submitted till 21.11.18"	1
30/11/18	Lab Dip Approve : Lab dip reject "Lab dip rejected 23.11.18. Buyer wants rev lab dip as 19-4329 TCX "	2
30/11/18	Lab Dip Approve : Lab dip reject "Reject due to yellow shade"	1
30/11/18	Lab Dip Approve : Shade reject "Lab dip rejected 23.11.18. Buyer wants rev lab dip as 12-2906 TCX "	1
30/11/18	Lab Dip Approve : Shade reject "Lab dip rejected 23.11.18. Buyer wants rev lab dip as 14-5413 TCX "	1
30/11/18	Lab Dip Approve : Shade reject "Lab dip rejected 23.11.18. Buyer wants rev lab dip as 19-4329 TCX "	1
30/11/18	-	20
31/12/18	Lab Dip Approve : Lab dip reject "Need more dark and less yellowish"	1
31/12/18	Lab Dip Approve : Lab dip reject "reject 2nd time . Need to match with provided std ."	1
31/12/18	Lab Dip Approve : Lab dip reject "Rejected 2nd time . Need to match with provided std ."	1
31/12/18	-	3

Figure 4.11: Event failure and delay analysis

Figure 4.11 shows a monthly report of failure reason with their relative frequency of occurrence. This summary report will help management to identify what are the primary and recurring root causes that are causing the most of the delay in event completion.

CHAPTER 5
DATA ANALYSIS AND RESULTS

5.1 TNA Data Collection

Before the implementation of production planning and control software, Excel spreadsheets were used to prepare and monitor Time and Action plan and updates. In this research work, a particular customer (Cotton On Group) is selected for the study. All purchase orders of a particular style of Cotton On Group before the implementation of production planning and control software are selected for the study. The TNA plan on the spreadsheet is collected. Then the Target (required) date and Complete date of all required TNA events of these orders are compared to calculate TNA hit rate.

After that, more purchase orders of the same style are selected which are executed after the implementation of production planning and control software. All the selected orders are of the same style to ensure the same TNA requirements. With the production planning and control software, users started directly updating the T&A event status in the planning board. From the software-generated reports, the TNA hit rate is calculated. Then the reasons liable for the delay in event completion are collected and those are analyzed with the Pareto diagram to identify 'Vital few' reasons. Finally, the root causes of those 'vital few' reasons are identified by interview and plotted against cause and effect diagram.

5.2 Event wise TNA Hit Rate in Conventional Plan

Twelve purchase orders of Tbar Fox Graphic T-Shirt style are found within the time period of January 2018 to June 2018. There are 16 events required to complete to execute each order. The average TNA hit rate for all the 12X16 = 192 events are calculated from the historical data recorded on the spreadsheet. The summary is given in Table 5.1 below:

Table 5.1: Event wise TNA Hit Rate in the conventional method

Event Name	Total Events	Late	On-time	On-time%
Fabric approval	12	11	1	8.33%
Fabric booking	12	5	7	58.33%
Fabric in house	12	10	2	16.67%
Fabric submission	12	7	5	41.67%
File Handover	12	12	0	0.00%
Grade Sample comments	12	8	4	33.33%
Grade Sample Submission	12	7	5	41.67%
Knitting complete	12	11	1	8.33%
Lab Dip approval	12	11	1	8.33%
Lab Dip submission	12	5	7	58.33%
Order Confirmation	12	2	10	83.33%
Print approval	12	11	1	8.33%
Print submission	12	5	7	58.33%
Trims booking	12	3	9	75.00%
Trims in house	12	10	2	16.67%
Yarn in house	12	11	1	8.33%
Grand Total	**192**	**129**	**63**	**32.81%**

5.3 Event wise TNA Hit Rate in PPC Software-based Plan

13 more purchase orders are found of Tbar Fox Graphic T-Shirt style which are executed after production planning and control software is implemented in the time period January 2019 to June 2019. The average TNA hit rate for all the 13X16 = 208 events is calculated from the data collected from the system generated report. The summary is given in table 5.3 below:

Table 5.2: Event wise TNA Hit Rate in the PPC software-based method

Event Name	Total Events	Late	On-time	On-time %
Fabric approval	13	12	1	7.69%
Fabric booking	13	3	10	76.92%
Fabric in house	13	10	3	23.08%
Fabric submission	13	5	8	61.54%
File Handover	13	8	5	38.46%
Grade Sample comments	13	7	6	46.15%
Grade Sample Submission	13	1	12	92.31%
Knitting complete	13	11	2	15.38%
Lab Dip approval	13	9	4	30.77%
Lab Dip submission	13	3	10	76.92%
Order Confirmation	13	2	11	84.62%
Print approval	13	7	6	46.15%
Print submission	13	4	9	69.23%
Trims booking	13	4	9	69.23%
Trims in house	13	9	4	30.77%
Yarn in house	13	11	2	15.38%
Grand Total	**208**	**106**	**102**	**49.04%**

5.4 Pareto Analysis on Reasons for event delay

The reasons for TNA event delay are collected from the software-generated report. Then the frequency of each delay reason is calculated and a Pareto analysis is conducted to identify which reasons are liable for 80% or more of the total event delay. Table 5.4 shows the number of events delayed against each reason in the frequency column. The next column shows a cumulative figure of the frequency and finally, the last column shows the cumulative figure in terms of percentage.

Table 5.3: Pareto analysis on the reasons for event delay

Reason for Event Delay	Frequency	Cumulative Frequency	Cumulative Percentage
Previous event delay	*19*	*19*	*17.92%*
Capacity problem	*18*	*37*	*34.91%*
Supplier delay	*16*	*53*	*50.00%*
Fabric quality reject	*12*	*65*	*61.32%*
Decision pending	*8*	*73*	*68.87%*
Booking Delay	*7*	*80*	*75.47%*
Shade mismatch	*7*	*87*	*82.08%*
Quality problem	5	92	86.79%
Order confirmation delay	3	95	89.62%
Print reject	3	98	92.45%
Approval delay	2	100	94.34%
Re-submission	2	102	96.23%
Transit delay	2	104	98.11%
Art work change	1	105	99.06%
Styling change	1	106	100.00%
Grand Total	**106**		

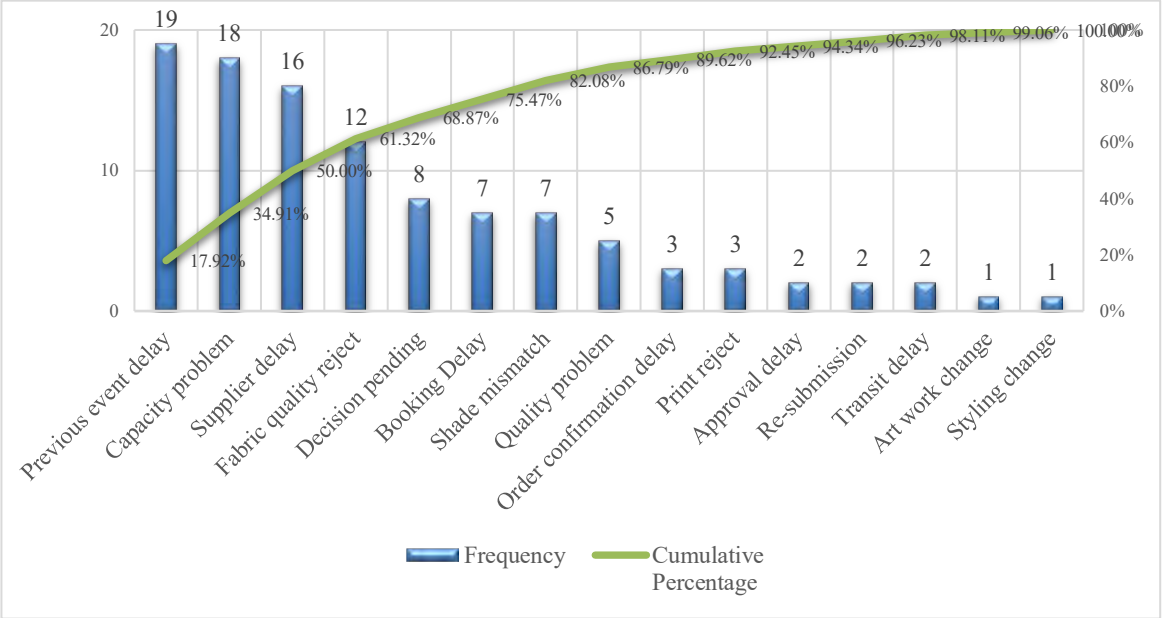

Figure 5.1: Pareto analysis on the reasons for event delay

The graph given in Figure 5.8 represents the 7 of the 15 late reasons contribute 82% of the total delay, and the rest of the 8 reasons are liable for only 18% of the total delay. So, it is evident that the time and effort needs to be focused on eliminating these seven reasons which will help to improve the TNA plan more.

5.5 Cause and Effect Diagram for Vital Few Reasons

It is important to know the root causes of the 'vital few' event delay reasons in order to eliminate them. The root causes of the reasons which caused most of the event delay are collected by interviewing the related personnel. The root causes identified by interview are as follows in Table 5.3:

Table 5.4: Root causes for delay in event completion

Sl.	Event Delay Reason	Root Cause
1	Decision pending	GSM/count confirmation delay
		Color confirmation delay
		Color-wise qty confirmation delay
		Dyeing machine capacity decision pending
		Shade approval delay
		Measurement chart approval delay
		Styling change
		Packing method change
		Hangtag confirmation delay
2	Shade mismatch	Sticker missing/mistake
		Overlapping with different fabric role
		Improper replacement
		Incorrect bundling
		Running shade mismatch
		Wrong dyeing recipe
		Incorrect cutting plan
3	Capacity Problem	Absenteeism
		Worker turnover
		Low working efficiency
		Approval pending
		Small quantity (MOQ)
		Overbooking
		Wide variety of styles
		Marketing policy
		Supply chain gap
		Plan change
4	Fabric Quality Reject	Wrong approval from the merchant
		Yarn lot mixing
		Lot mixing of dyeing preparation
		Uneven dyeing
		GSM issue
		Knitting hole
		Thick/thin problem of yarn
		Nets fault
		Patta problem of fabric
		Softener problem

Table 5.4 (Continued): Root causes for delay in event completion

Sl.	Event Delay Reason	Root Cause
5	Supplier delay	LC delay
		Holiday in the supplier country
		Approval delay
		Capacity problem of supplier
		Raw material shortage of supplier
		Booking delay
		Insufficient lead time provided to the supplier
6	Booking delay	Excessive workload
		PO confirmation delay
		Size breakdown delay
		Packing instruction/ratio delay
		Test requirement approval delay
		Accessories layout delay
		Rare composition of yarn construction (no supplier)
		Price negotiation
		Color approval delay
		Fabrication (count confirmation) delay
		Sample approval delay
		Decision pending

Now, it will be easy for the management to focus the time and resource towards the above identified root causes of the event delay. If these root causes can be eliminated by bringing required changes in the respective process, the TNA plan Hit Rate will improve significantly.

Then those root causes for every delay reason are plotted against a cause and effect diagram as below:

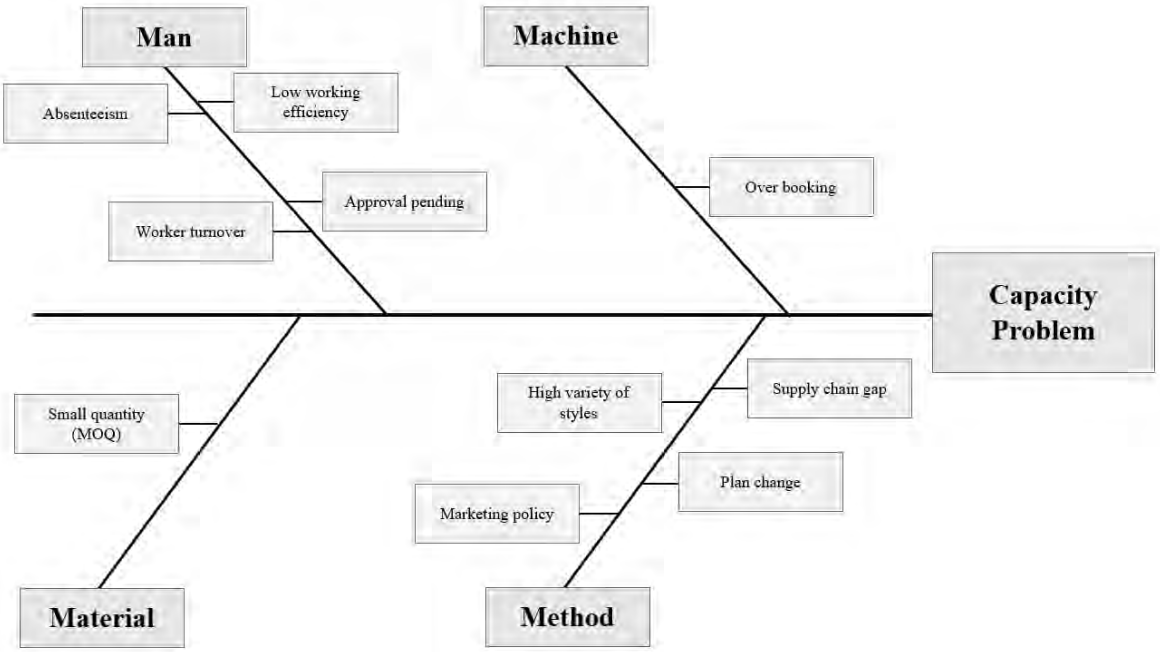

Figure 5.2: Cause and Effect diagram on 'Capacity Problem'

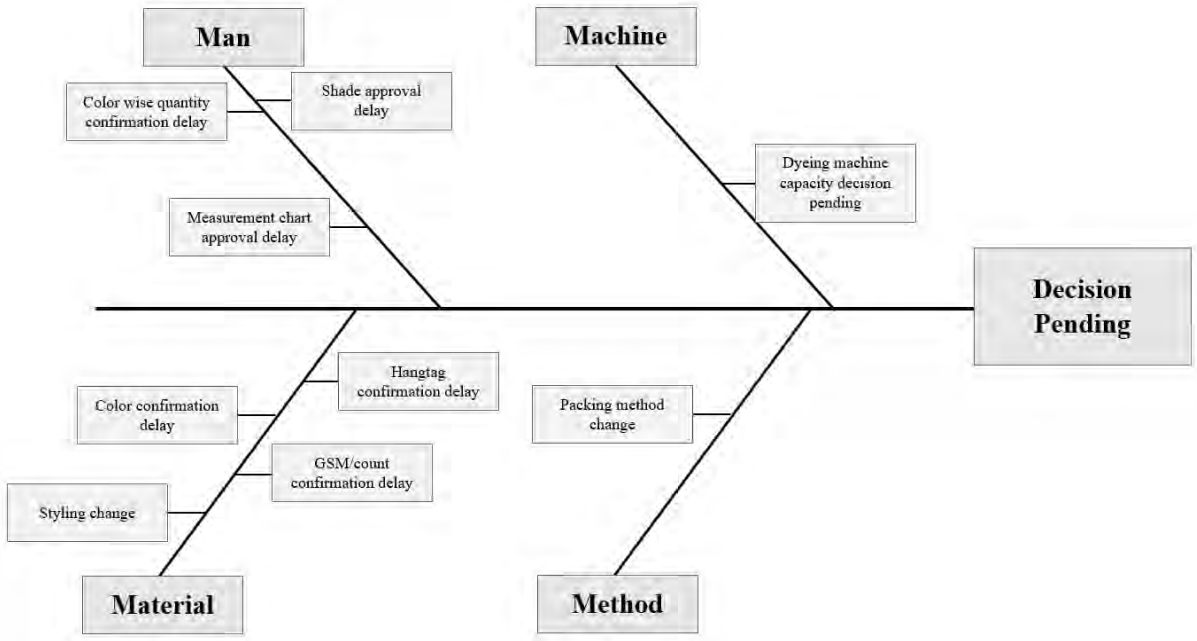

Figure 5.3: Cause and Effect diagram on 'Decision pending'

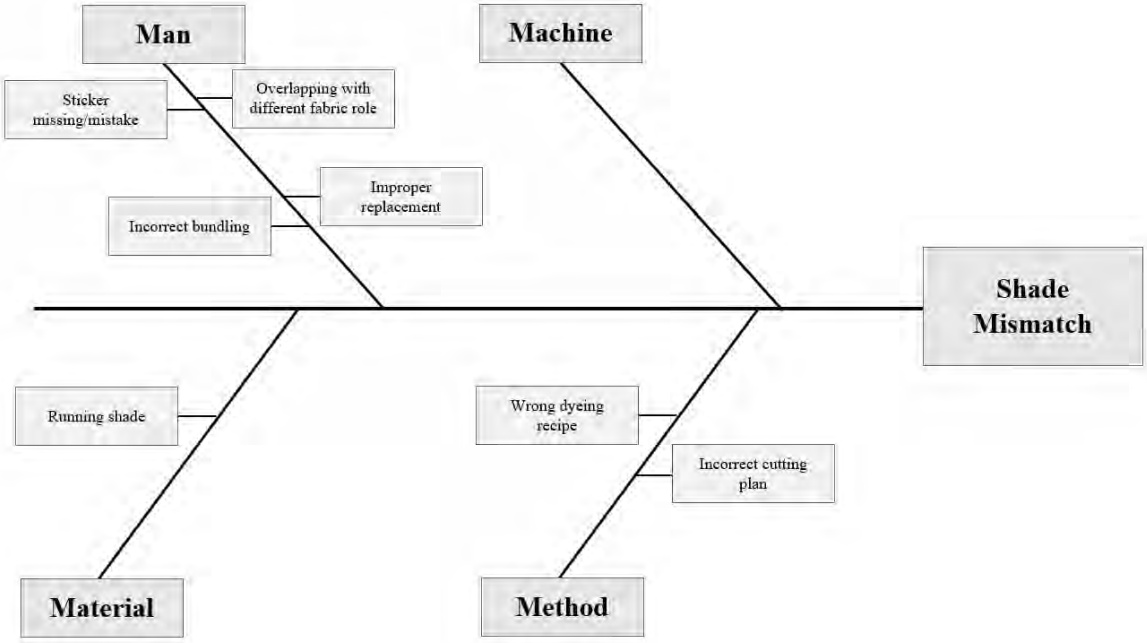

Figure 5.4: Cause and Effect diagram on 'Shade mismatch'

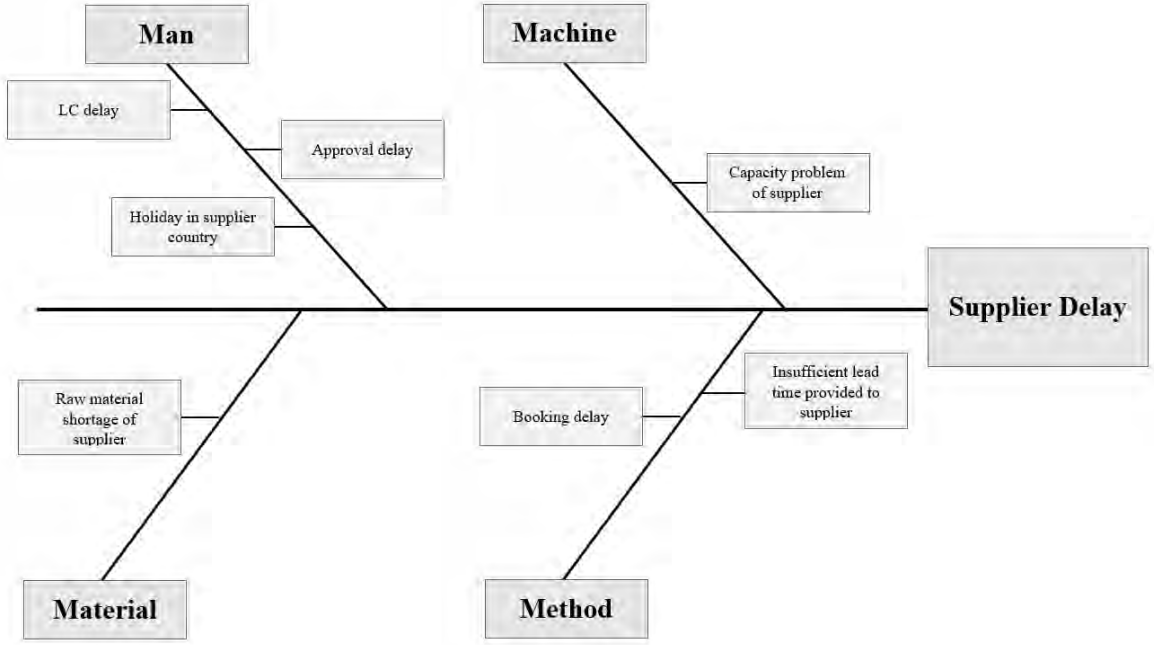

Figure 5.5: Cause and Effect diagram on 'Supplier delay'

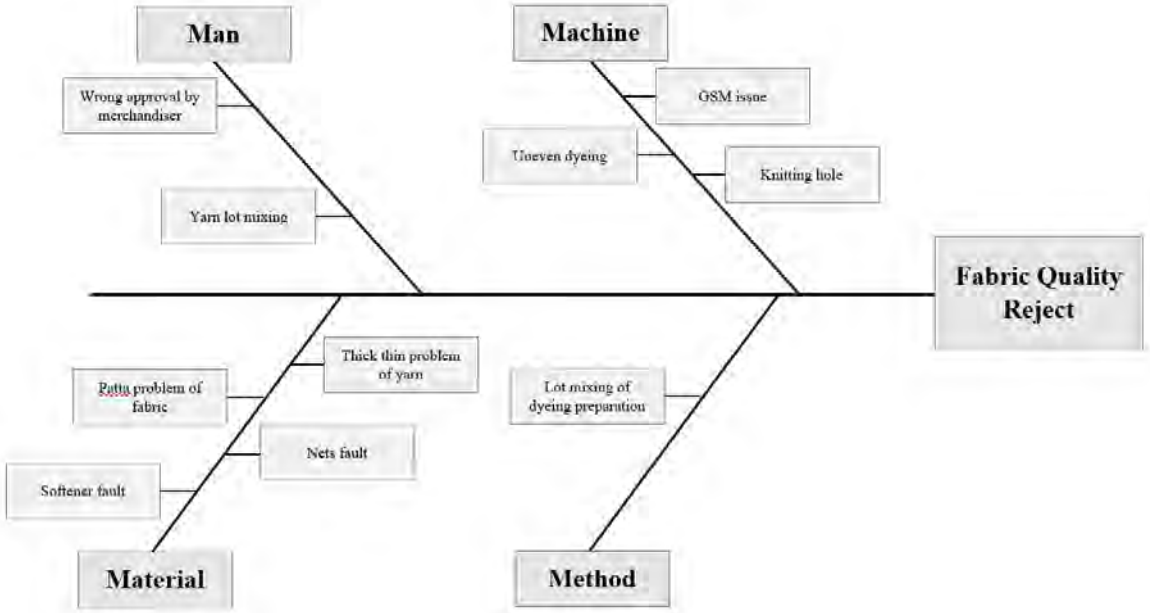

Figure 5.6: Cause and Effect diagram on 'Fabric quality reject'

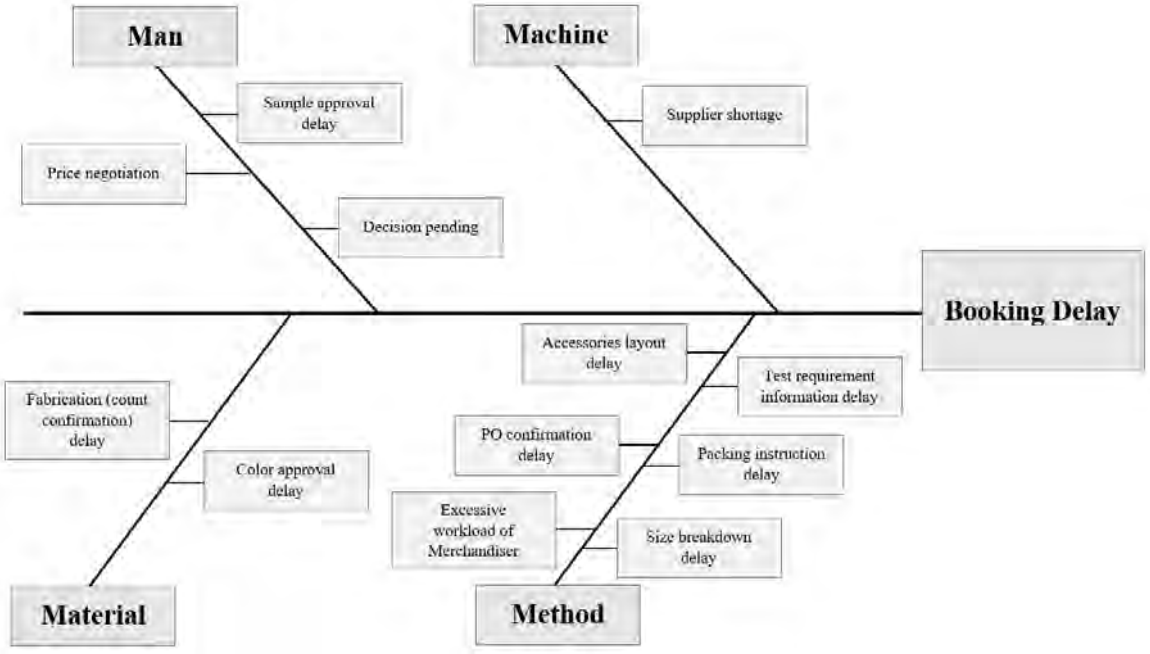

Figure 5.7: Cause and Effect diagram on 'Booking delay'

5.6 Result

After the implementation of integrated production planning and control software, it was possible to bring all the departments related to the Time and Action plan into the same page. Integrated production planning and control software also made it possible to ensure that everyone is getting the latest updates and decisions on which they can set a correct priority. It also reduced the chance of human error and slippage. All these contributed to the improvement in the TNA hit rate over the conventional Time and Action plan. In the below Figure 5.9, the comparison of TNA hit rate in the conventional method and integrated software-based method is represented:

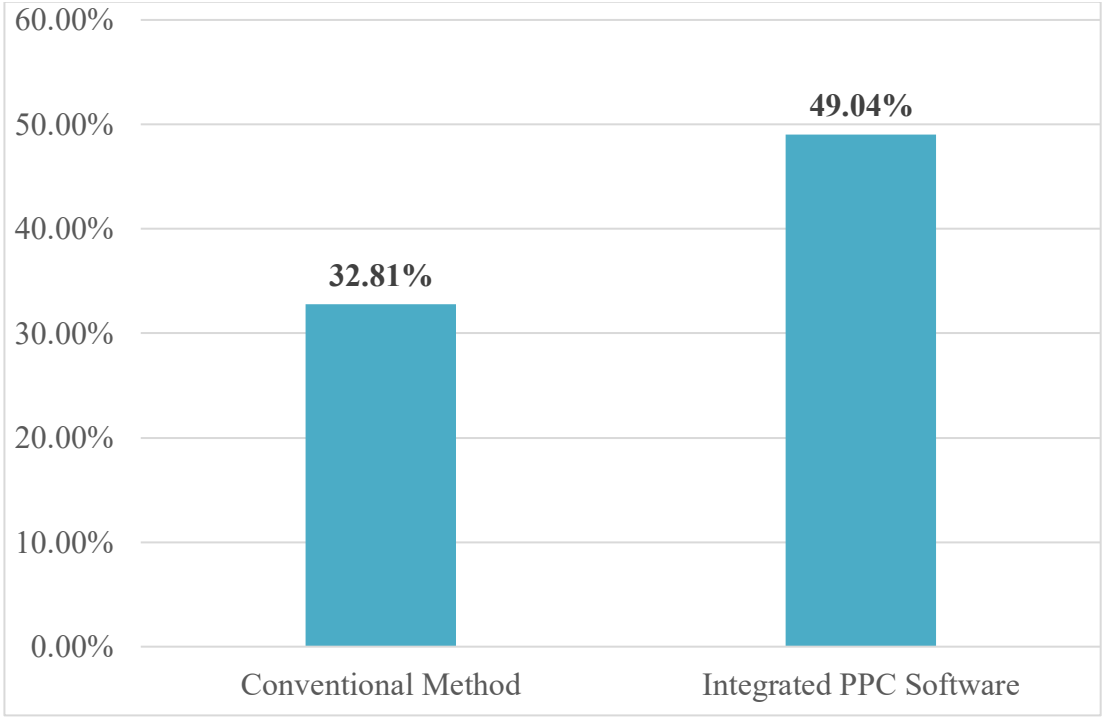

Figure 5.8: TNA Hit rate comparison in the conventional and PPC software-based TNA plan

So, the TNA Hit rate is improved from 32.81% to 49.04% after the implementation of integrated production and control software.

CHAPTER 6
CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

Time and action plan data was collected for customer orders of a style 'Tbar fox Graphic T-shirt' before integrated production planning and control software was implemented. Then TNA data was collected for more customer orders of the same style after the implementation of Integrated PPC software. Comparing the TNA events completion and delay analysis, the following conclusions can be drawn from this study:

1. Sixteen key events are required to complete the Time and Action plan for a customer order of Cotton On.
2. Before the implementation of production planning and control software, On-time hit rate of these 16 TNA events for selected customer orders was 32.81%.
3. A few months after the implementation of production planning and control software, On-time hit rate of these 16 TNA events for selected similar customer orders was 49.04%. That means, integrated production planning and control software significantly improved the rate of on-time event completion.
4. The 'vital few' seven reasons which caused more than 80% of the total event delay are identified using the pareto diagram. Finally, the root causes of these 'vital few' reasons are identified and presented in Cause and Effect diagram which will be guideline for the manufacturer to bring further improvement in the TNA plan by eliminating the root causes of the delay.

The main challenges in the conventional way of managing the time and action of the apparel industry are a communication gap between different departments within the company and outside suppliers, lack of proper visual tracking of what needs to be done and when needs to be done, proper performance evaluation, etc. Due to these challenges, the apparel industries of Bangladesh are suffering a lot in this area. That is why firefighting to hit the delivery date is a regular scenario. Most of the time TNA activities take longer than it should take and hence, production lead time shrinks. As a

result, to complete production within a shorter time, excessive overtime needs to be applied.

Moreover, sometimes, delivery extension time needs to be taken at the cost of a discount or penalty. Air shipment is also an alternative in such cases. All these cases incur extra cost to the manufacturer and the ultimate result is loss of profit margin. The main essence of integrated production planning and control software is to be a single source of information. Making all the decisions based on the same departments and staff are entirely aligned. Besides, the Software based TNA planning board is a visual management tool that makes monitoring and updating events easier for the responsible person.

Furthermore, as the Time and Action events are linked with the production plan in an integrated production planning and control system, it is possible to generate the priority and requirement, which is realistic and just in time. It reduces unnecessary holding of raw material inventory. In a nutshell, an integrated production planning and control software can help to overcome the challenges of time and action plan and improve its performance.

6.2 Limitations and Recommendation for Future Work

This research work has below-mentioned limitations:

- Due to the limitation of resources and the availability of data, the research work is conducted based on the data collected from only one company and one category of orders.
- The financial outcome of implementing integrated production planning and control software is not included in the study.

In future similar analysis could be done on the data collected from multiple companies and styling and this will ensure a more accurate and reliable result. Furthermore, research work can be done on the justification of the investment in the implementation of integrated PPC software based on the ROI analysis. Besides, another research can be done the contribution of integrated PPC software in inventory reduction as in Integrated PPC software, TNA events can be directly linked with the production start dates.

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Appendix A

TNA Event completion record in the conventional method

Order 01 Details

Customer	Cotton on Group	**Product Type**	Tbar Fox Graphic T Shirt
Order No.	328867	**Brand**	Ladies Wear
Style No.	249902	**Fabrication**	Single Jersey, 160GR
Order Quantity	8768	**Print**	CST - Sublimation
Season	Q-1	**Embroidery**	No
Delivery Date	15/01/2018	**Wash**	No

- **TNA Record**

Events	Target Date	Complete Date	On-time/Late	Remarks
Order Confirmation	17/10/2017	17/10/2017	On-time	
Print submission	27/10/2017	28/10/2017	Late	Art work change
Print approval	09/11/2017	12/11/2017	Late	Previous event delay
Trims booking	01/11/2017	01/11/2017	On-time	
Trims in house	01/12/2017	02/12/2017	Late	Other
Lab Dip submission	03/11/2017	03/11/2017	On-time	
Lab Dip approval	10/11/2017	12/11/2017	Late	Shade mismatch
Fabric booking	20/10/2017	20/10/2017	On-time	
Yarn in house	25/10/2017	28/10/2017	Late	Booking Delay
Knitting complete	30/10/2017	01/11/2017	Late	Early plan
Fabric submission	04/11/2017	07/11/2017	Late	Fabric quality reject
Fabric approval	09/11/2017	12/11/2017	Late	Previous event delay
Fabric in house	04/12/2017	05/12/2017	Late	Previous event delay
Grade Sample Submission	14/11/2017	14/11/2017	On-time	
Grade Sample comments	19/11/2017	20/11/2017	Late	Quality problem
File Handover	11/12/2017	14/12/2017	Late	Decision pending

Order 02 Details

Customer	Cotton on Group	**Product Type**	Tbar Fox Graphic T Shirt
Order No.	303405	**Brand**	Ladies Wear
Style No.	249902	**Fabrication**	Single Jersey, 160GR
Order Quantity	159	**Print**	CST - Sublimation
Season	Q-1	**Embroidery**	No
Delivery Date	19/02/2018	**Wash**	No

- **TNA Record**

Events	Target Date	Complete Date	On-time/Late	Remarks
Order Confirmation	21/11/2017	21/11/2017	On-time	
Print submission	01/12/2017	01/12/2017	On-time	
Print approval	14/12/2017	17/12/2017	Late	Re-submission
Trims booking	06/12/2017	06/12/2017	On-time	
Trims in house	05/01/2018	06/01/2018	Late	Capacity problem
Lab Dip submission	08/12/2017	08/12/2017	On-time	
Lab Dip approval	15/12/2017	17/12/2017	Late	Shade mismatch
Fabric booking	24/11/2017	24/11/2017	On-time	
Yarn in house	29/11/2017	02/12/2017	Late	Booking Delay
Knitting complete	04/12/2017	06/12/2017	Late	Early plan
Fabric submission	09/12/2017	12/12/2017	Late	Fabric quality reject
Fabric approval	14/12/2017	17/12/2017	Late	Previous event delay
Fabric in house	08/01/2018	09/01/2018	Late	Previous event delay
Grade Sample Submission	19/12/2017	21/12/2017	Late	Quality problem
Grade Sample comments	24/12/2017	25/12/2017	Late	Previous event delay
File Handover	15/01/2018	18/01/2018	Late	Decision pending

Order 03 Details

Customer	Cotton on Group	**Product Type**	Tbar Fox Graphic T Shirt
Order No.	332489	**Brand**	Ladies Wear
Style No.	249902	**Fabrication**	Single Jersey, 160GR
Order Quantity	2740	**Print**	CST - Sublimation
Season	Q-1	**Embroidery**	No
Delivery Date	12/03/2018	**Wash**	No

- **TNA Record**

Events	Target Date	Complete Date	On-time/Late	Remarks
Order Confirmation	12/12/2017	12/12/2017	On-time	
Print submission	22/12/2017	22/12/2017	On-time	
Print approval	04/01/2018	06/01/2018	Late	Styling change
Trims booking	27/12/2017	25/12/2017	On-time	
Trims in house	26/01/2018	25/01/2018	On-time	
Lab Dip submission	29/12/2017	29/12/2017	On-time	
Lab Dip approval	05/01/2018	08/01/2018	Late	Shade mismatch
Fabric booking	15/12/2017	15/12/2017	On-time	
Yarn in house	20/12/2017	22/12/2017	Late	Supplier delay
Knitting complete	25/12/2017	27/12/2017	Late	Booking Delay
Fabric submission	30/12/2017	03/01/2018	Late	Other
Fabric approval	04/01/2018	08/01/2018	Late	Previous event delay
Fabric in house	29/01/2018	02/02/2018	Late	Transit delay
Grade Sample Submission	09/01/2018	10/01/2018	Late	Previous event delay
Grade Sample comments	14/01/2018	17/01/2018	Late	Fabric quality reject
File Handover	05/02/2018	07/02/2018	Late	Previous event delay

Order 04 Details

Customer	Cotton on Group	**Product Type**	Tbar Fox Graphic T Shirt
Order No.	329256	**Brand**	Ladies Wear
Style No.	249902	**Fabrication**	Single Jersey, 160GR
Order Quantity	1551	**Print**	CST - Sublimation
Season	Q-1	**Embroidery**	No
Delivery Date	26/03/2018	**Wash**	No

- **TNA Record**

Events	Target Date	Complete Date	On-time/Late	Remarks
Order Confirmation	26/12/2017	27/12/2017	Late	Order confirmation delay
Print submission	05/01/2018	06/01/2018	Late	Decision pending
Print approval	18/01/2018	19/01/2018	Late	Print reject
Trims booking	10/01/2018	09/01/2018	On-time	
Trims in house	09/02/2018	11/02/2018	Late	Supplier delay
Lab Dip submission	12/01/2018	11/01/2018	On-time	
Lab Dip approval	19/01/2018	20/01/2018	Late	Shade mismatch
Fabric booking	29/12/2017	30/12/2017	Late	Order confirmation delay
Yarn in house	03/01/2018	05/01/2018	Late	Booking Delay
Knitting complete	08/01/2018	11/01/2018	Late	Capacity problem
Fabric submission	13/01/2018	12/01/2018	On-time	
Fabric approval	18/01/2018	20/01/2018	Late	Fabric quality reject
Fabric in house	12/02/2018	11/02/2018	On-time	
Grade Sample Submission	23/01/2018	22/01/2018	On-time	
Grade Sample comments	28/01/2018	27/01/2018	On-time	
File Handover	19/02/2018	21/02/2018	Late	Decision pending

Order 05 Details

Customer	Cotton on Group	**Product Type**	Tbar Fox Graphic T Shirt
Order No.	335761	**Brand**	Ladies Wear
Style No.	249902	**Fabrication**	Single Jersey, 160GR
Order Quantity	100	**Print**	CST - Sublimation
Season	Q-2	**Embroidery**	No
Delivery Date	02/04/2018	**Wash**	No

- **TNA Record**

Events	Target Date	Complete Date	On-time/Late	Remarks
Order Confirmation	02/01/2018	02/01/2018	On-time	
Print submission	12/01/2018	12/01/2018	On-time	
Print approval	25/01/2018	29/01/2018	Late	Re-submission
Trims booking	17/01/2018	17/01/2018	On-time	
Trims in house	16/02/2018	18/02/2018	Late	Supplier delay
Lab Dip submission	19/01/2018	21/01/2018	Late	Capacity problem
Lab Dip approval	26/01/2018	28/01/2018	Late	Previous event delay
Fabric booking	05/01/2018	06/01/2018	Late	Approval delay
Yarn in house	10/01/2018	12/01/2018	Late	Booking Delay
Knitting complete	15/01/2018	16/01/2018	Late	Capacity problem
Fabric submission	20/01/2018	20/01/2018	On-time	
Fabric approval	25/01/2018	28/01/2018	Late	Fabric quality reject
Fabric in house	19/02/2018	20/02/2018	Late	Approval delay
Grade Sample Submission	30/01/2018	31/01/2018	Late	Previous event delay
Grade Sample comments	04/02/2018	06/02/2018	Late	Previous event delay
File Handover	26/02/2018	01/03/2018	Late	Previous event delay

Order 06 Details

Customer	Cotton on Group	**Product Type**	Tbar Fox Graphic T Shirt
Order No.	332511	**Brand**	Ladies Wear
Style No.	249902	**Fabrication**	Single Jersey, 160GR
Order Quantity	400	**Print**	CST - Sublimation
Season	Q-2	**Embroidery**	No
Delivery Date	09/04/2018	**Wash**	No

- **TNA Record**

Events	Target Date	Complete Date	On-time/Late	Remarks
Order Confirmation	09/01/2018	09/01/2018	On-time	
Print submission	19/01/2018	19/01/2018	On-time	
Print approval	01/02/2018	02/02/2018	Late	Print reject
Trims booking	24/01/2018	24/01/2018	On-time	
Trims in house	23/02/2018	24/02/2018	Late	Supplier delay
Lab Dip submission	26/01/2018	28/01/2018	Late	Decision pending
Lab Dip approval	02/02/2018	03/02/2018	Late	Previous event delay
Fabric booking	12/01/2018	12/01/2018	On-time	
Yarn in house	17/01/2018	20/01/2018	Late	Transit delay
Knitting complete	22/01/2018	24/01/2018	Late	Capacity problem
Fabric submission	27/01/2018	27/01/2018	On-time	
Fabric approval	01/02/2018	04/02/2018	Late	Fabric quality reject
Fabric in house	26/02/2018	28/02/2018	Late	Capacity problem
Grade Sample Submission	06/02/2018	07/02/2018	Late	Styling change
Grade Sample comments	11/02/2018	13/02/2018	Late	Previous event delay
File Handover	05/03/2018	07/03/2018	Late	Re-submission

Order 07 Details

Customer	Cotton on Group	**Product Type**	Tbar Fox Graphic T Shirt
Order No.	338932	**Brand**	Ladies Wear
Style No.	249902	**Fabrication**	Single Jersey, 160GR
Order Quantity	2402	**Print**	CST - Sublimation
Season	Q-2	**Embroidery**	No
Delivery Date	16/04/2018	**Wash**	No

- **TNA Record**

Events	Target Date	Complete Date	On-time/Late	Remarks
Order Confirmation	16/01/2018	16/01/2018	On-time	
Print submission	26/01/2018	26/01/2018	On-time	
Print approval	08/02/2018	09/02/2018	Late	Art work change
Trims booking	31/01/2018	31/01/2018	On-time	
Trims in house	02/03/2018	02/03/2018	On-time	
Lab Dip submission	02/02/2018	04/02/2018	Late	Capacity problem
Lab Dip approval	09/02/2018	10/02/2018	Late	Shade mismatch
Fabric booking	19/01/2018	20/01/2018	Late	Decision pending
Yarn in house	24/01/2018	26/01/2018	Late	Transit delay
Knitting complete	29/01/2018	01/02/2018	Late	Capacity problem
Fabric submission	03/02/2018	04/02/2018	Late	Buyer's holiday
Fabric approval	08/02/2018	09/02/2018	Late	Previous event delay
Fabric in house	05/03/2018	07/03/2018	Late	Capacity problem
Grade Sample Submission	13/02/2018	15/02/2018	Late	Previous event delay
Grade Sample comments	18/02/2018	19/02/2018	Late	Previous event delay
File Handover	12/03/2018	14/03/2018	Late	Previous event delay

Order 08 Details

Customer	Cotton on Group	**Product Type**	Tbar Fox Graphic T Shirt
Order No.	338936	**Brand**	Ladies Wear
Style No.	249902	**Fabrication**	Single Jersey, 160GR
Order Quantity	2870	**Print**	CST - Sublimation
Season	Q-2	**Embroidery**	No
Delivery Date	16/04/2018	**Wash**	No

- **TNA Record**

Events	Target Date	Complete Date	On-time/Late	Remarks
Order Confirmation	16/01/2018	17/01/2018	Late	Order confirmation delay
Print submission	26/01/2018	25/01/2018	On-time	
Print approval	08/02/2018	07/02/2018	On-time	
Trims booking	31/01/2018	01/02/2018	Late	Order confirmation delay
Trims in house	02/03/2018	03/03/2018	Late	Booking Delay
Lab Dip submission	02/02/2018	01/02/2018	On-time	
Lab Dip approval	09/02/2018	08/02/2018	On-time	
Fabric booking	19/01/2018	20/01/2018	Late	Order confirmation delay
Yarn in house	24/01/2018	25/01/2018	Late	Booking Delay
Knitting complete	29/01/2018	30/01/2018	Late	Booking Delay
Fabric submission	03/02/2018	05/02/2018	Late	Previous event delay
Fabric approval	08/02/2018	07/02/2018	On-time	
Fabric in house	05/03/2018	07/03/2018	Late	Booking Delay
Grade Sample Submission	13/02/2018	15/02/2018	Late	Previous event delay
Grade Sample comments	18/02/2018	17/02/2018	On-time	
File Handover	12/03/2018	13/03/2018	Late	Previous event delay

Order 09 Details

Customer	Cotton on Group	**Product Type**	Tbar Fox Graphic T Shirt
Order No.	341086	**Brand**	Ladies Wear
Style No.	249902	**Fabrication**	Single Jersey, 160GR
Order Quantity	1000	**Print**	CST - Sublimation
Season	Q-2	**Embroidery**	No
Delivery Date	30/04/2018	**Wash**	No

- **TNA Record**

Events	Target Date	Complete Date	On-time/Late	Remarks
Order Confirmation	30/01/2018	30/01/2018	On-time	
Print submission	09/02/2018	09/02/2018	On-time	
Print approval	22/02/2018	24/02/2018	Late	Print reject
Trims booking	14/02/2018	14/02/2018	On-time	
Trims in house	16/03/2018	19/03/2018	Late	Supplier delay
Lab Dip submission	16/02/2018	16/02/2018	On-time	
Lab Dip approval	23/02/2018	25/02/2018	Late	Shade mismatch
Fabric booking	02/02/2018	03/02/2018	Late	Decision pending
Yarn in house	07/02/2018	10/02/2018	Late	Booking Delay
Knitting complete	12/02/2018	13/02/2018	Late	Capacity problem
Fabric submission	17/02/2018	17/02/2018	On-time	
Fabric approval	22/02/2018	25/02/2018	Late	Fabric quality reject
Fabric in house	19/03/2018	22/03/2018	Late	Booking Delay
Grade Sample Submission	27/02/2018	27/02/2018	On-time	
Grade Sample comments	04/03/2018	06/03/2018	Late	Quality problem
File Handover	26/03/2018	27/03/2018	Late	Previous event delay

Order 10 Details

Customer	Cotton on Group	**Product Type**	Tbar Fox Graphic T Shirt
Order No.	343875	**Brand**	Ladies Wear
Style No.	249902	**Fabrication**	Single Jersey, 160GR
Order Quantity	3199	**Print**	CST - Sublimation
Season	Q-2	**Embroidery**	No
Delivery Date	14/05/2018	**Wash**	No

- **TNA Record**

Events	Target Date	Complete Date	On-time/Late	Remarks
Order Confirmation	13/02/2018	13/02/2018	On-time	
Print submission	23/02/2018	24/02/2018	Late	Capacity problem
Print approval	08/03/2018	10/03/2018	Late	Print reject
Trims booking	28/02/2018	28/02/2018	On-time	
Trims in house	30/03/2018	01/04/2018	Late	Supplier delay
Lab Dip submission	02/03/2018	02/03/2018	On-time	
Lab Dip approval	09/03/2018	11/03/2018	Late	Shade mismatch
Fabric booking	16/02/2018	16/02/2018	On-time	
Yarn in house	21/02/2018	21/02/2018	On-time	
Knitting complete	26/02/2018	26/02/2018	On-time	
Fabric submission	03/03/2018	03/03/2018	On-time	
Fabric approval	08/03/2018	11/03/2018	Late	Fabric quality reject
Fabric in house	02/04/2018	03/04/2018	Late	Capacity problem
Grade Sample Submission	13/03/2018	14/03/2018	Late	Decision pending
Grade Sample comments	18/03/2018	20/03/2018	Late	Fabric quality reject
File Handover	09/04/2018	10/04/2018	Late	Previous event delay

Order 11 Details

Customer	Cotton on Group	**Product Type**	Tbar Fox Graphic T Shirt
Order No.	344410	**Brand**	Ladies Wear
Style No.	249902	**Fabrication**	Single Jersey, 160GR
Order Quantity	10271	**Print**	CST - Sublimation
Season	Q-2	**Embroidery**	No
Delivery Date	21/05/2018	**Wash**	No

- **TNA Record**

Events	Target Date	Complete Date	On-time/Late	Remarks
Order Confirmation	20/02/2018	20/02/2018	On-time	
Print submission	02/03/2018	03/03/2018	Late	Capacity problem
Print approval	15/03/2018	17/03/2018	Late	Previous event delay
Trims booking	07/03/2018	08/03/2018	Late	Decision pending
Trims in house	06/04/2018	09/04/2018	Late	Booking Delay
Lab Dip submission	09/03/2018	10/03/2018	Late	Capacity problem
Lab Dip approval	16/03/2018	20/03/2018	Late	Shade mismatch
Fabric booking	23/02/2018	23/02/2018	On-time	
Yarn in house	28/02/2018	02/03/2018	Late	Booking Delay
Knitting complete	05/03/2018	07/03/2018	Late	Capacity problem
Fabric submission	10/03/2018	11/03/2018	Late	Previous event delay
Fabric approval	15/03/2018	17/03/2018	Late	Fabric quality reject
Fabric in house	09/04/2018	11/04/2018	Late	Capacity problem
Grade Sample Submission	20/03/2018	20/03/2018	On-time	
Grade Sample comments	25/03/2018	25/03/2018	On-time	
File Handover	16/04/2018	17/04/2018	Late	Previous event delay

Order 12 Details

Customer	Cotton on Group	**Product Type**	Tbar Fox Graphic T Shirt
Order No.	345085	**Brand**	Ladies Wear
Style No.	249902	**Fabrication**	Single Jersey, 160GR
Order Quantity	898	**Print**	CST - Sublimation
Season	Q-2	**Embroidery**	No
Delivery Date	28/05/2018	**Wash**	No

- **TNA Record**

Events	Target Date	Complete Date	On-time/Late	Remarks
Order Confirmation	27/02/2018	27/02/2018	On-time	
Print submission	09/03/2018	10/03/2018	Late	Decision pending
Print approval	22/03/2018	24/03/2018	Late	Previous event delay
Trims booking	14/03/2018	15/03/2018	Late	Decision pending
Trims in house	13/04/2018	16/04/2018	Late	Booking Delay
Lab Dip submission	16/03/2018	17/03/2018	Late	Decision pending
Lab Dip approval	23/03/2018	27/03/2018	Late	Shade mismatch
Fabric booking	02/03/2018	02/03/2018	On-time	
Yarn in house	07/03/2018	09/03/2018	Late	Booking Delay
Knitting complete	12/03/2018	14/03/2018	Late	Capacity problem
Fabric submission	17/03/2018	18/03/2018	Late	Previous event delay
Fabric approval	22/03/2018	24/03/2018	Late	Fabric quality reject
Fabric in house	16/04/2018	16/04/2018	On-time	
Grade Sample Submission	27/03/2018	27/03/2018	On-time	
Grade Sample comments	01/04/2018	01/04/2018	On-time	
File Handover	23/04/2018	24/04/2018	Late	Previous event delay

TNA Event completion record in production planning and control software based method

Order 01 Details

Customer	Cotton on Group	**Product Type**	Tbar Fox Graphic T Shirt
Order No.	375059	**Brand**	Ladies Wear
Style No.	2004202	**Fabrication**	Single Jersey, 160GR
Order Quantity	220	**Print**	CST - Pigment
Season	Q-1	**Embroidery**	No
Delivery Date	07/01/2019	**Wash**	No

❑ **TNA Record**

Events	Target Date	Complete Date	On-time/Late	Remarks
Order Confirmation	09/10/2018	09/10/2018	On-time	
Print submission	19/10/2018	22/10/2018	Late	Art work change
Print approval	01/11/2018	02/11/2018	Late	Previous event delay
Trims booking	24/10/2018	25/10/2018	Late	Decision pending
Trims in house	23/11/2018	25/11/2018	Late	Supplier delay
Lab Dip submission	26/10/2018	26/10/2018	On-time	
Lab Dip approval	02/11/2018	03/11/2018	Late	Shade mismatch
Fabric booking	12/10/2018	12/10/2018	On-time	
Yarn in house	17/10/2018	17/10/2018	On-time	
Knitting complete	22/10/2018	23/10/2018	Late	Capacity problem
Fabric submission	27/10/2018	28/10/2018	Late	Quality problem
Fabric approval	01/11/2018	03/11/2018	Late	Fabric quality reject
Fabric in house	26/11/2018	26/11/2018	On-time	
Grade Sample Submission	06/11/2018	06/11/2018	On-time	
Grade Sample comments	11/11/2018	11/11/2018	On-time	
File Handover	03/12/2018	03/12/2018	On-time	

Order 02 Details

Customer	Cotton on Group	**Product Type**	Tbar Fox Graphic T Shirt
Order No.	386564	**Brand**	Ladies Wear
Style No.	2004202	**Fabrication**	Single Jersey, 160GR
Order Quantity	1699	**Print**	CST - Pigment
Season	Q-1	**Embroidery**	No
Delivery Date	14/01/2019	**Wash**	No

❑ **TNA Record**

Events	Target Date	Complete Date	On-time/Late	Remarks
Order Confirmation	16/10/2018	17/10/2018	Late	Order confirmation delay
Print submission	26/10/2018	26/10/2018	On-time	
Print approval	08/11/2018	08/11/2018	On-time	
Trims booking	31/10/2018	31/10/2018	On-time	
Trims in house	30/11/2018	30/11/2018	On-time	
Lab Dip submission	02/11/2018	02/11/2018	On-time	
Lab Dip approval	09/11/2018	11/11/2018	Late	Shade mismatch
Fabric booking	19/10/2018	19/10/2018	On-time	
Yarn in house	24/10/2018	25/10/2018	Late	Transit delay
Knitting complete	29/10/2018	28/10/2018	On-time	
Fabric submission	03/11/2018	03/11/2018	On-time	
Fabric approval	08/11/2018	08/11/2018	On-time	
Fabric in house	03/12/2018	05/12/2018	Late	Supplier delay
Grade Sample Submission	13/11/2018	14/11/2018	Late	Previous event delay
Grade Sample comments	18/11/2018	20/11/2018	Late	Fabric quality reject
File Handover	10/12/2018	12/12/2018	Late	Previous event delay

Order 03 Details

Customer	Cotton on Group	**Product Type**	Tbar Fox Graphic T Shirt
Order No.	384321	**Brand**	Ladies Wear
Style No.	2007110	**Fabrication**	Single Jersey, 160GR
Order Quantity	3889	**Print**	CST - Highcover
Season	Q-1	**Embroidery**	No
Delivery Date	21/01/2019	**Wash**	No

❑ **TNA Record**

Events	Target Date	Complete Date	On-time/Late	Remarks
Order Confirmation	23/10/2018	23/10/2018	On-time	
Print submission	02/11/2018	03/11/2018	Late	Decision pending
Print approval	15/11/2018	16/11/2018	Late	Previous event delay
Trims booking	07/11/2018	07/11/2018	On-time	
Trims in house	07/12/2018	08/12/2018	Late	Supplier delay
Lab Dip submission	09/11/2018	09/11/2018	On-time	
Lab Dip approval	16/11/2018	16/11/2018	On-time	
Fabric booking	26/10/2018	26/10/2018	On-time	
Yarn in house	31/10/2018	31/10/2018	On-time	
Knitting complete	05/11/2018	06/11/2018	Late	Capacity problem
Fabric submission	10/11/2018	11/11/2018	Late	Previous event delay
Fabric approval	15/11/2018	16/11/2018	Late	Fabric quality reject
Fabric in house	10/12/2018	12/12/2018	Late	Capacity problem
Grade Sample Submission	20/11/2018	20/11/2018	On-time	
Grade Sample comments	25/11/2018	28/11/2018	Late	Quality problem
File Handover	17/12/2018	18/12/2018	Late	Previous event delay

Order 04 Details

Customer	Cotton on Group	**Product Type**	Tbar Fox Graphic T Shirt
Order No.	387222	**Brand**	Ladies Wear
Style No.	2004202	**Fabrication**	Single Jersey, 160GR
Order Quantity	3245	**Print**	CST - Sublimation
Season	Q-1	**Embroidery**	No
Delivery Date	28/01/2019	**Wash**	No

❑ **TNA Record**

Events	Target Date	Complete Date	On-time/Late	Remarks
Order Confirmation	30/10/2018	30/10/2018	On-time	
Print submission	09/11/2018	09/11/2018	On-time	
Print approval	22/11/2018	22/11/2018	On-time	
Trims booking	14/11/2018	14/11/2018	On-time	
Trims in house	14/12/2018	16/12/2018	Late	Supplier delay
Lab Dip submission	16/11/2018	17/11/2018	Late	Decision pending
Lab Dip approval	23/11/2018	26/11/2018	Late	Shade mismatch
Fabric booking	02/11/2018	03/11/2018	Late	Decision pending
Yarn in house	07/11/2018	09/11/2018	Late	Supplier delay
Knitting complete	12/11/2018	14/11/2018	Late	Capacity problem
Fabric submission	17/11/2018	17/11/2018	On-time	
Fabric approval	22/11/2018	24/11/2018	Late	Fabric quality reject
Fabric in house	17/12/2018	19/12/2018	Late	Capacity problem
Grade Sample Submission	27/11/2018	27/11/2018	On-time	
Grade Sample comments	02/12/2018	02/12/2018	On-time	
File Handover	24/12/2018	24/12/2018	On-time	

Order 05 Details

Customer	Cotton on Group	**Product Type**	Tbar Fox Graphic T Shirt
Order No.	384333	**Brand**	Ladies Wear
Style No.	2007110	**Fabrication**	Single Jersey, 160GR
Order Quantity	547	**Print**	CST - Highcover
Season	Q-1	**Embroidery**	No
Delivery Date	04/02/2019	**Wash**	No

❑ **TNA Record**

Events	Target Date	Complete Date	On-time/Late	Remarks
Order Confirmation	06/11/2018	06/11/2018	On-time	
Print submission	16/11/2018	16/11/2018	On-time	
Print approval	29/11/2018	01/12/2018	Late	Print reject
Trims booking	21/11/2018	21/11/2018	On-time	
Trims in house	21/12/2018	22/12/2018	Late	Supplier delay
Lab Dip submission	23/11/2018	23/11/2018	On-time	
Lab Dip approval	30/11/2018	01/12/2018	Late	Shade mismatch
Fabric booking	09/11/2018	09/11/2018	On-time	
Yarn in house	14/11/2018	16/11/2018	Late	Supplier delay
Knitting complete	19/11/2018	21/11/2018	Late	Capacity problem
Fabric submission	24/11/2018	24/11/2018	On-time	
Fabric approval	29/11/2018	01/12/2018	Late	Fabric quality reject
Fabric in house	24/12/2018	25/12/2018	Late	Capacity problem
Grade Sample Submission	04/12/2018	04/12/2018	On-time	
Grade Sample comments	09/12/2018	11/12/2018	Late	Quality problem
File Handover	31/12/2018	01/01/2019	Late	Decision pending

Order 06 Details

Customer	Cotton on Group	**Product Type**	Tbar Fox Graphic T Shirt
Order No.	387839	**Brand**	Ladies Wear
Style No.	2004202	**Fabrication**	Single Jersey, 160GR
Order Quantity	1652	**Print**	CST - Sublimation
Season	Q-1	**Embroidery**	No
Delivery Date	11/02/2019	**Wash**	No

❑ **TNA Record**

Events	Target Date	Complete Date	On-time/Late	Remarks
Order Confirmation	13/11/2018	15/11/2018	Late	Order confirmation delay
Print submission	23/11/2018	23/11/2018	On-time	
Print approval	06/12/2018	07/12/2018	Late	Print reject
Trims booking	28/11/2018	28/11/2018	On-time	
Trims in house	28/12/2018	28/12/2018	On-time	
Lab Dip submission	30/11/2018	30/11/2018	On-time	
Lab Dip approval	07/12/2018	08/12/2018	Late	Re-submission
Fabric booking	16/11/2018	17/11/2018	Late	Order confirmation delay
Yarn in house	21/11/2018	22/11/2018	Late	Supplier delay
Knitting complete	26/11/2018	28/11/2018	Late	Capacity problem
Fabric submission	01/12/2018	01/12/2018	On-time	
Fabric approval	06/12/2018	07/12/2018	Late	Approval delay
Fabric in house	31/12/2018	02/01/2019	Late	Supplier delay
Grade Sample Submission	11/12/2018	11/12/2018	On-time	
Grade Sample comments	16/12/2018	17/12/2018	Late	Fabric quality reject
File Handover	07/01/2019	08/01/2019	Late	Previous event delay

Order 07 Details

Customer	Cotton on Group	**Product Type**	Tbar Fox Graphic T Shirt
Order No.	384259	**Brand**	Ladies Wear
Style No.	2007108	**Fabrication**	Single Jersey, 160GR
Order Quantity	669	**Print**	CST - CMYK
Season	Q-1	**Embroidery**	No
Delivery Date	18/02/2019	**Wash**	No

❑ **TNA Record**

Events	Target Date	Complete Date	On-time/Late	Remarks
Order Confirmation	20/11/2018	20/11/2018	On-time	
Print submission	30/11/2018	30/11/2018	On-time	
Print approval	13/12/2018	13/12/2018	On-time	
Trims booking	05/12/2018	06/12/2018	Late	Approval delay
Trims in house	04/01/2019	06/01/2019	Late	Booking Delay
Lab Dip submission	07/12/2018	07/12/2018	On-time	
Lab Dip approval	14/12/2018	14/12/2018	On-time	
Fabric booking	23/11/2018	24/11/2018	Late	Booking Delay
Yarn in house	28/11/2018	29/11/2018	Late	Capacity problem
Knitting complete	03/12/2018	05/12/2018	Late	Capacity problem
Fabric submission	08/12/2018	08/12/2018	On-time	
Fabric approval	13/12/2018	15/12/2018	Late	Fabric quality reject
Fabric in house	07/01/2019	08/01/2019	Late	Capacity problem
Grade Sample Submission	18/12/2018	18/12/2018	On-time	
Grade Sample comments	23/12/2018	24/12/2018	Late	Fabric quality reject
File Handover	14/01/2019	15/01/2019	Late	Previous event delay

Order 08 Details

Customer	Cotton on Group	**Product Type**	Tbar Fox Graphic T Shirt
Order No.	389165	**Brand**	Ladies Wear
Style No.	2004202	**Fabrication**	Single Jersey, 160GR
Order Quantity	1499	**Print**	CST - Sublimation
Season	Q-1	**Embroidery**	No
Delivery Date	25/02/2019	**Wash**	No

❑ **TNA Record**

Events	Target Date	Complete Date	On-time/Late	Remarks
Order Confirmation	27/11/2018	27/11/2018	On-time	
Print submission	07/12/2018	07/12/2018	On-time	
Print approval	20/12/2018	21/12/2018	Late	Print reject
Trims booking	12/12/2018	12/12/2018	On-time	
Trims in house	11/01/2019	12/01/2019	Late	Supplier delay
Lab Dip submission	14/12/2018	14/12/2018	On-time	
Lab Dip approval	21/12/2018	23/12/2018	Late	Shade mismatch
Fabric booking	30/11/2018	30/11/2018	On-time	
Yarn in house	05/12/2018	06/12/2018	Late	Supplier delay
Knitting complete	10/12/2018	11/12/2018	Late	Capacity problem
Fabric submission	15/12/2018	15/12/2018	On-time	
Fabric approval	20/12/2018	21/12/2018	Late	Fabric quality reject
Fabric in house	14/01/2019	16/01/2019	Late	Capacity problem
Grade Sample Submission	25/12/2018	25/12/2018	On-time	
Grade Sample comments	30/12/2018	31/12/2018	Late	Quality problem
File Handover	21/01/2019	21/01/2019	On-time	

Order 09 Details

Customer	Cotton on Group	**Product Type**	Tbar Fox Graphic T Shirt
Order No.	387843	**Brand**	Ladies Wear
Style No.	2004202	**Fabrication**	Single Jersey, 160GR
Order Quantity	1499	**Print**	CST - Sublimation
Season	Q-1	**Embroidery**	No
Delivery Date	04/03/2019	**Wash**	No

❑ **TNA Record**

Events	Target Date	Complete Date	On-time/Late	Remarks
Order Confirmation	04/12/2018	04/12/2018	On-time	
Print submission	14/12/2018	14/12/2018	On-time	
Print approval	27/12/2018	27/12/2018	On-time	
Trims booking	19/12/2018	19/12/2018	On-time	
Trims in house	18/01/2019	18/01/2019	On-time	
Lab Dip submission	21/12/2018	22/12/2018	Late	Previous event delay
Lab Dip approval	28/12/2018	30/12/2018	Late	Shade mismatch
Fabric booking	07/12/2018	07/12/2018	On-time	
Yarn in house	12/12/2018	14/12/2018	Late	Booking Delay
Knitting complete	17/12/2018	17/12/2018	On-time	
Fabric submission	22/12/2018	22/12/2018	On-time	
Fabric approval	27/12/2018	29/12/2018	Late	Fabric quality reject
Fabric in house	21/01/2019	20/01/2019	On-time	
Grade Sample Submission	01/01/2019	01/01/2019	On-time	
Grade Sample comments	06/01/2019	07/01/2019	Late	Quality problem
File Handover	28/01/2019	28/01/2019	On-time	

Order 10 Details

Customer	Cotton on Group	**Product Type**	Tbar Fox Graphic T Shirt
Order No.	397169	**Brand**	Ladies Wear
Style No.	2007110	**Fabrication**	Single Jersey, 160GR
Order Quantity	128	**Print**	CST - Sublimation
Season	Q-1	**Embroidery**	No
Delivery Date	11/03/2019	**Wash**	No

❑ **TNA Record**

Events	Target Date	Complete Date	On-time/Late	Remarks
Order Confirmation	11/12/2018	11/12/2018	On-time	
Print submission	21/12/2018	22/12/2018	Late	Styling change
Print approval	03/01/2019	04/01/2019	Late	Previous event delay
Trims booking	26/12/2018	27/12/2018	Late	Decision pending
Trims in house	25/01/2019	27/01/2019	Late	Booking Delay
Lab Dip submission	28/12/2018	29/12/2018	Late	Capacity problem
Lab Dip approval	04/01/2019	07/01/2019	Late	Shade mismatch
Fabric booking	14/12/2018	14/12/2018	On-time	
Yarn in house	19/12/2018	21/12/2018	Late	Supplier delay
Knitting complete	24/12/2018	25/12/2018	Late	Capacity problem
Fabric submission	29/12/2018	29/12/2018	On-time	
Fabric approval	03/01/2019	05/01/2019	Late	Fabric quality reject
Fabric in house	28/01/2019	30/01/2019	Late	Capacity problem
Grade Sample Submission	08/01/2019	08/01/2019	On-time	
Grade Sample comments	13/01/2019	13/01/2019	On-time	
File Handover	04/02/2019	05/02/2019	Late	Previous event delay

Order 11 Details

Customer	Cotton on Group	**Product Type**	Tbar Fox Graphic T Shirt
Order No.	402237	**Brand**	Ladies Wear
Style No.	2007108	**Fabrication**	Single Jersey, 160GR
Order Quantity	4368	**Print**	CST - Sublimation
Season	Q-2	**Embroidery**	No
Delivery Date	15/04/2019	**Wash**	No

❑ **TNA Record**

Events	Target Date	Complete Date	On-time/Late	Remarks
Order Confirmation	15/01/2019	15/01/2019	On-time	
Print submission	25/01/2019	25/01/2019	On-time	
Print approval	07/02/2019	07/02/2019	On-time	
Trims booking	30/01/2019	31/01/2019	Late	Decision pending
Trims in house	01/03/2019	03/03/2019	Late	Booking Delay
Lab Dip submission	01/02/2019	01/02/2019	On-time	
Lab Dip approval	08/02/2019	08/02/2019	On-time	
Fabric booking	18/01/2019	18/01/2019	On-time	
Yarn in house	23/01/2019	24/01/2019	Late	Booking Delay
Knitting complete	28/01/2019	30/01/2019	Late	Previous event delay
Fabric submission	02/02/2019	03/02/2019	Late	Booking Delay
Fabric approval	07/02/2019	10/02/2019	Late	Fabric quality reject
Fabric in house	04/03/2019	06/03/2019	Late	Previous event delay
Grade Sample Submission	12/02/2019	12/02/2019	On-time	
Grade Sample comments	17/02/2019	17/02/2019	On-time	
File Handover	11/03/2019	12/03/2019	Late	Previous event delay

Order 12 Details

Customer	Cotton on Group	**Product Type**	Tbar Fox Graphic T Shirt
Order No.	406565	**Brand**	Ladies Wear
Style No.	2007108	**Fabrication**	Single Jersey, 160GR
Order Quantity	4368	**Print**	CST - CMYK
Season	Q-2	**Embroidery**	No
Delivery Date	06/05/2019	**Wash**	No

❑ **TNA Record**

Events	Target Date	Complete Date	On-time/Late	Remarks
Order Confirmation	05/02/2019	05/02/2019	On-time	
Print submission	15/02/2019	16/02/2019	Late	Decision pending
Print approval	28/02/2019	29/02/2019	Late	Previous event delay
Trims booking	20/02/2019	20/02/2019	On-time	
Trims in house	22/03/2019	24/03/2019	Late	Transit delay
Lab Dip submission	22/02/2019	22/02/2019	On-time	
Lab Dip approval	01/03/2019	03/03/2019	Late	Re-submission
Fabric booking	08/02/2019	08/02/2019	On-time	
Yarn in house	13/02/2019	15/02/2019	Late	Supplier delay
Knitting complete	18/02/2019	20/02/2019	Late	Capacity problem
Fabric submission	23/02/2019	24/02/2019	Late	Supplier delay
Fabric approval	28/02/2019	30/02/2019	Late	Previous event delay
Fabric in house	25/03/2019	28/03/2019	Late	Capacity problem
Grade Sample Submission	05/03/2019	04/03/2019	On-time	
Grade Sample comments	10/03/2019	08/03/2019	On-time	
File Handover	01/04/2019	04/04/2019	Late	Previous event delay

Order 13 Details

Customer	Cotton on Group	**Product Type**	Tbar Fox Graphic T Shirt
Order No.	405886	**Brand**	Ladies Wear
Style No.	2007108	**Fabrication**	Single Jersey, 160GR
Order Quantity	4368	**Print**	CST - Sublimation
Season	Q-2	**Embroidery**	No
Delivery Date	27/05/2019	**Wash**	No

❑ **TNA Record**

Events	Target Date	Complete Date	On-time/Late	Remarks
Order Confirmation	26/02/2019	26/02/2019	On-time	
Print submission	08/03/2019	08/03/2019	On-time	
Print approval	21/03/2019	21/03/2019	On-time	
Trims booking	13/03/2019	13/03/2019	On-time	
Trims in house	12/04/2019	12/04/2019	On-time	
Lab Dip submission	15/03/2019	15/03/2019	On-time	
Lab Dip approval	22/03/2019	22/03/2019	On-time	
Fabric booking	01/03/2019	01/03/2019	On-time	
Yarn in house	06/03/2019	09/03/2019	Late	Supplier delay
Knitting complete	11/03/2019	13/03/2019	Late	Supplier delay
Fabric submission	16/03/2019	17/03/2019	Late	Previous event delay
Fabric approval	21/03/2019	23/03/2019	Late	Previous event delay
Fabric in house	15/04/2019	15/04/2019	On-time	
Grade Sample Submission	26/03/2019	26/03/2019	On-time	
Grade Sample comments	31/03/2019	31/03/2019	On-time	
File Handover	22/04/2019	22/04/2019	On-time	Previous event delay

Appendix B

Table: Questionnaire

Sl.	Questionnaire	Response
1	What are the root causes of the material booking delay?	
2	What are the root causes of delays by a supplier delivering goods?	
3	What are the root causes of the shade mismatch?	
4	What are the root causes of the capacity problem?	
5	What are the root causes of Fabric Quality Reject?	
6	What are the root causes that lead to decision pending?	