



KIOT

CAD in pattern making

Target group: 3rd year GED

Chapter two

PATTEN DESIGN SYSTEM (PDS)

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Introduction

- The philosophy underlying this direction of development is that there has been a shift in emphasis in the clothing industry and the production of garment patterns is now a key factor in the total response time of the clothing manufacturer.
- Thus the importance of having an integrated system for producing pattern quickly and accurately has become essential for fashion producers who have to maintain and continually improve their competitive edge.

Introduction

- To develop total pattern system which have four integrated function :
 1. Master Pattern System(MPS) : to create block pattern.
 2. Pattern Design System (PDS) : for the construction and development of styled patterns
 3. Pattern Generation System (PGS): to automatically generate patterns for secondary materials.
 4. Dynamic Pattern Grading (DPG): to automate, as far as possible, all of the process concerned with the grading of garment patterns.

Master Pattern System

- A development of the European producers of CAD system
- Objective:
 - To produce block patterns according to given measurements and ease allowance
- A typical module has three modules, men, women and children
- The block patterns can be constructed according to the user system or via a system developed by the manufacturer of the CAD unit.
- In each case ,the user can interact with the system to effect any changes or modifications which might be required.

Master Pattern System

- It is also possible to change ease allowance according to styling or fabric.
- The major developments of master pattern system have been for men's wear, but those for women and children are on the way to development .

Pattern Design System

- The development of PDS can be divided into two phase:
 1. Pattern construction on the screen which is, in effect, flat pattern cutting at a reduced scale.
- To automate many of the repetitive manual operations associated with pattern making.
- The system became more user friendly with pop-up menus and windows.
- The system became more sophisticate and more easier to use.

Pattern Design System

- There were two major problems with the systems on the market :
 - The pattern cutter was working at a reduced scale, which is not conducive to visually judging proportions.
 - The working methods were computerized , which necessitated the learning of each operation from scratch
- 2. An American company, Gerber Garment Technology, introduced an interactive pattern development system which enabled the pattern cutter to work at full scale using their own familiar tool and techniques.

Pattern Design System

- The pattern cutter could draw style lines on a block pattern and then verify and enhance them via the screen or by redrawing.
- So, far only 2D PDS has been examined ,but recently A new technology has emerged which enables the pattern cutter to actually model a design in 3D via the system. basically the system produces a 3D wire-frame image of the workroom stand, the pattern cutter, using a computer generated fabric , can model the garment on to the body image.

Pattern Generating System (PGS)

- This system was developed in 1985 and the objective was to automate the generation of patterns for linings and fusible directly from the top cloth patterns .
- Preparing patterns for secondary materials involves many repetitious operations, which with very small variations are the same for every garment, irrespective of styling.
- For example, constructing a pattern for a front fusible would involve the same operations for every front, i.e. copying the front cloth pattern and then modifying it to suit the manufacturing technology used by the factory .

Dynamic Pattern System

- It is a very recent development and although very little information is available regarding the system itself, its developers forecast that it will be generally available in about one year from the time of writing.
- The operative principle of the system is based on the explicit grading relationship between a block pattern and the styled pattern developed from it.
- The grade for the styled pattern is directly derived from that of the block pattern.

APPAREL PATTERN DESIGN SYSTEMS (PDS)

- Pattern Design System/Software offers intuitive and powerful software tools designed to work with patterns at every step of your production cycle.
- Activities of PDS
 1. Drafting pattern pieces from scratch with drafting and editing tools,
 2. digitize existing hard-copy patterns with digitizing tools,
 3. Editing and finalizing existing digital patterns, all within the same interface.
- Includes the entire range of pattern making tools one would use for manually drafting patterns on the table yet presents them to the user in very accessible and easy to use toolboxes.
- Four basic elements when producing drawings using a PDS
 1. Points
 2. Straight lines
 3. Archs
 4. Curves

- Constituents of PDS
 - Movable toolbars
 - dialog boxes allow each design engineer to create their own working environment.
 - Icons and tools are organized by functionality: Tools related to drafting, editing, and measuring your patterns are all grouped together to provide quick access to the tools you use most. Hotkeys allow you to quickly access your most heavily-used functions without ever needing to access a menu.
 - Darts, seam allowance, special corners, advanced measurement techniques, pleats, complicated curves, dimension modifications, and facings, have been specially developed to meet the needs of our customers across a wide range of product types.

Richpiece and lectra PDS

- Types of PDS
 - 1. Auto design**
 - 2. Pattern made by hand import**
 - 3. Free design**

1. **Auto design-** There are many pattern library in software, thus easy for modifying part size and order size, Grading automatically, Offer of accurate data for calculating material, Also can establish Pattern library by yourself
2. **Pattern made by hand import-** You can input pattern to computer by camera or digitizer or digitizer mouse can input one size, Also can Input more size.



Pattern Digitizing

3. Free design

- Intelligent pen- When make design line, Can input data size directly Improve efficiency; set size, Match divided point on line;
- Mouse wheel and space- Zoom out or zoom in or move pattern;
- Line modification- Curve line and straight line connect smoothly
- Move and rotate adjust- Can combine more group design line and pattern line then adjust;
- Measure- Can refresh measured data automatically;
- Transfer dart-Can transfer dart in one circle, in different circle, Transfer equally one dart to more dart, Also can transfer whole in proportion, can keep or move the dart tip, Insert dart in appointed place.
- Add pleat- knife pleat, Box pleat, Front or back pleat, Also can add whole pleat and half pleat, Can add straight line pleat and curve line pleat, Insert pleat in appointed place e.t.c.
- Flouncing- Can make start and end equal width flouncing, Also can make start and end non equal width flouncing;
- Forfex pattern - It offer colour filled pattern, Select line to create pattern, Make square to form pattern and hollow pattern function, And can create seam allowance automatically;
- Seam- Seam and pattern border is associated, Seam will refresh automatically after adjusting border, set and modifies together equal seam or same corner place can set or modify together, Special Seam allowance also associated;
- Notch-fix and modify notches, Can add equal distance notch on one or more lines, more kind of notch type, Can match notch simultaneously on sleeve and front and back;
- Create interlining- Create interlining on pattern automatically;

- **Free design**

- Pic lib- Software offer hundreds of sewing sign, also can modify size, Move and rotate the available part;
- Sew line/Quilted line- offer more kinds of straight line and curved line, You can group freely, Quilted line can select between single and cross line, Angles can set freely;
- Shrink /Part shrink- Can shrink all the material same pattern, Also can shrink pattern parts;
- Safe restore- System auto save each file, System will Help u find unsaved data;
- Encrypt file- System can encrypt file, File can not be copied and stolen;
- ASTM/TIIP- Can import ASTM、 TIIP file and output ASTM, Share with our CAD;
- Custom toolbar- Tool can group freely on interface, can be set freely by right click button;

Other Tasks of Richpiece PDS

- **Grading**
- **Pattern modify**
- **Pattern nesting**
- **Plotting**

- **Grading**

- Auto confirm “+” or “-” When use point grading, System can recognize grading value “+” or “-” automatically;
- Grading together of part which grading value is same- Can square and grade more points together;
- Equal grading between pattern border and assistant line- Assistant line can grade together with border, also can grade separately;
- Fixed measurement grade- Can grade according to curve or straight line length ;
- Size group- Can grade in one group ,Also can grade in different group;
- Text grading- Different size can have same text and also can have different size, text can be placed on grade tool;
- Button hole/Drill- Can add equal drill or button hole , Also can add same distance drill/button hole. When grading different size button holes or drill, quantity can be the same or different;
- Grading value copying- Can copy one and paste one, Also can copy one and paste more.

- **Pattern modify**

- Shadow- When modify pattern, shadow appears, You can compare before and after modifying pattern and Can go back original shape;
- Move all or only move line – when adjusting more parts in same way, Can be adjusted together;
- Adjust Sizes- when adjusting other sizes except basic size, When adjusting pattern, can adjust one single size or all the sizes, also can adjust in proportions;
- Show line length-Can show line length automatically;
- Adjust pleat and dart merged dart- On basic size or graded dart and pleat, it can combine dart and pleat and make it smooth;
- Compare pattern work- can compare one pattern work with another pattern, also combine and adjust line smoothly.

Nest

- **Nesting-** positioning of 2-D shapes/pattern on a sheet so as to achieve maximum usage of a material or equivalently to minimize wastage.
- Super nest- Efficiency is higher than manual nest and takes short time, separates color 、 also has binding and fixing pattern function;
- Calculate(Estimate) material- Can calculate each marker material consumption (Include length and weight) automatically (or manually) thus cut down factory cost;
- System can separate material automatically according to different type of material;
- Easy operate when make marker by hand- Can finish flip, Overlap, slide patterns with mouse or shortcut button;
- Check overlap- Can check overlap between pattern;
- Double marker- Can make marker on main or aided marker;
- Reference marker- Can make marker in reference to an earlier finished marker;
- Duplicate/Reverse marker- Can duplicate or Reverse marker on a partly finished marker
- Associate marker with patterns- After make marker, Marker can change automatically when pattern change;
- Group nest- can group nest and cut as a group

- **Plot**

- Output Mode- Can plot whole marker cutting or Half cutting;
- Plot line type- Shows inside border, outside border and assistant line type can be set separately;
- Plot selected page- Plot appointed marker;
- Marker title- Can plot detailed instruction at end or at start of marker;
- Check plotting- If there are missed pattern or same side pattern or different material pattern, System can check automatically.



Pattern Plotter

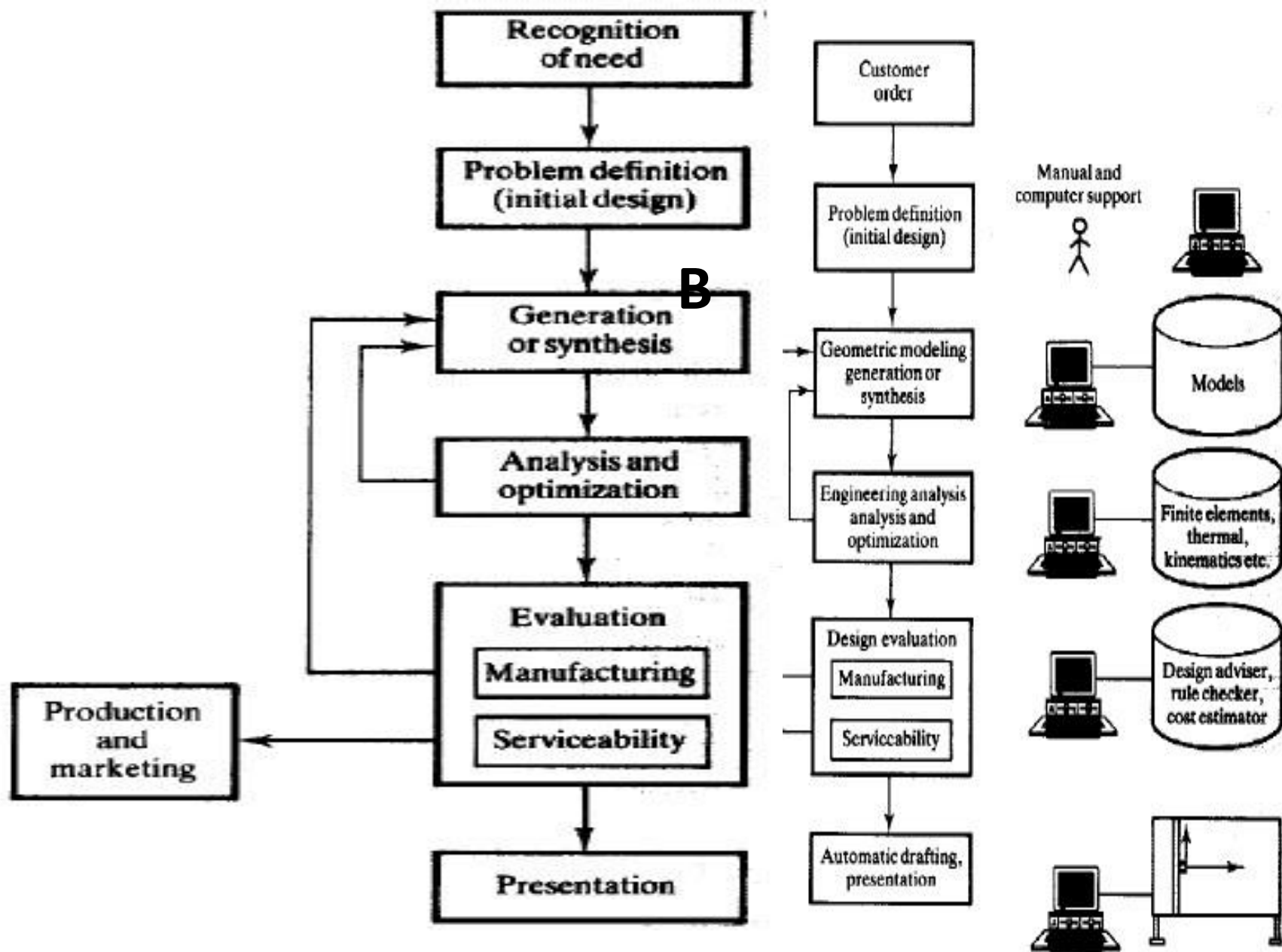
COMPARISON OF MANUAL AND CAD SYSTEMS

No	Aspects of comparison	Manual	Computerized
	Flexibility in design	Low	High
	Percentage wastage in fabric cutting	High	
	quality of cutting room		
	sample making time		
	Productivity.		
	Lead time for production		

COMPARISON OF MANUAL AND CAD SYSTEMS

Greater flexibility in pattern designing, grading and marking, reduction in waste %, increase in quality of cutting room and reduction in sample making time are some of the benefits of application of CAD/CAM system in garment manufacturing.

A



(A) The traditional generalized design process, and (B) IT applications in the design process.

- **Aspects of comparison**
 - Time required in pattern designing, grading, pattern alteration.
 - Waste percentage in cutting room.
 - Quality of cutting.
 - Time taken for sample making.
 - Productivity.
 - Lead time for production.

Time required in pattern designing, grading, pattern alteration

- Observations of particular time required for each operation observed

Time taken for the following activities in CAD/CAM system

Activity	Unit - C (in min)
New pattern creation	15.22
Grading (Four size)	5.67
Marker planning	5.92
Sketch preparation	00.00
Total	36.81

Time taken for CAD/CAM System

Time taken for the following activities in manual system

Activity	Unit - M (in min)
New pattern creation	100.00
Grading (Four size)	120.00
Marker planning	100.00
Sketch preparation	30.00
Total	350.00

Time taken for manual system

- Time reduction in CAD for pattern designing, grading and marking: As mentioned in the experimental procedure, the CAD/CAM system takes 36.81 minutes, whereas MANUAL system takes 350 minutes. By this, one can say that the MANUAL system takes nearly 10 times of the time taken by the CAD/CAM system.
- MANUAL system takes comparatively much more time because of: New Pattern Creation, Measurement of Marking, Pattern Grading, Marker Planning, Sketching, etc. These activities are done only by an individual and so the time taken depends on the skill of the person
- CAD tools to draft pattern, gives unlimited saving in time compared to the manual method. A previously constructed pattern in the system can be used as the base pattern for a new style.
- Reduction in pattern designing, grading, and pattern alteration time by around 90%.

- **Waste percentage in cutting operation**

In order to determine waste percentage in both manual and CAD/CAM system, following observations were made. The fabric consumption for 500 shirts was determined by taking the dimension of centre size, i.e., 'L' the area of front, back and sleeve part of shirt is taken for 'L' size shirt. The fabric required is 2.15 meters without tolerance. With tolerance, the fabric required is 2.4 meters.

Total no of shirts observed = 500

Fabric required for 500 shirts = 500×2.42

= 1209.06 mts

= 1210 mts

No of shirts made out from 1210 meters with (90% fabric realization) in CAD/CAM system:

= (1210×90) 1100

= 1089 mts.

= $1089/2.42$

No of shirts = 450

No of shirts made out from 1210 meters with (80% fabric realization) in MANUAL system:

= $(1210 \times 80) / 100$

= 968 mts

= $968/2.42$

No of shirts - 403

This exhibits a fabric saving of 10% by CAD/CAM system over MANUAL

- **Waste percentage in cutting room:**

With the use of CAD/CAM system through experimental procedure it can be observed that about 10% of material is saved, as compared to the manual method. This is achieved due to the following reason:

1. Do not cut until a trial layout shows the best location for all pieces within minimum length of cloth.
2. Place all pattern pieces close together, so as to reduce the waste % of the cloth.
3. Spreading waste is considerably reduced due to correct length spreading, remnants are also reduced by SPREAD machine. Since the CAD/CAM system has mathematical algorithms in-built in CAD System, this ensures the most economical use of material.

- **Quality of cutting:**

In order to determine the quality of cutting, 10 rolls from 100 rolls of cloth were received both in cutting and sewing department. It was observed every day. Amount of rejected garment was collected taking into consideration the following quality particulars:

- Fabric defects.
- All components cut on the correct grain lines and in accordance with the pile direction of the fabric.
- Dimensionally accurate garment that do not exceed specified tolerance.
- All materials spread at correct tension to prevent under- or over-sized component and/or garment.
- Consistent and accurate marking.

Quality of cutting in Unit – C		
Day	No of rolls	Rejection %
1	10	0.3
2	10	0.2
3	10	0.3
4	10	0.4
5	10	0.3
6	10	0.6
7	10	0.6
8	10	0.3
9	10	0.4
10	10	0.4

CAD/CAM System

Quality of cutting in Unit – M		
Day	No of rolls	Rejection %
1	10	0.5
2	10	0.6
3	10	1.1
4	10	1.2
5	10	1.1
6	10	0.9
7	10	1.1
8	10	1.2
9	10	1.4
10	10	1.2

manual system

Quality of cutting:

- As mentioned in the experimental procedure, the CAD/CAM system has 0.38% of the waste reduction whereas MANUAL System has 1.03%.
- Increasing quality of cutting room by around 50%.
- This shows that quality is very good in CAD/CAM because,
 - the spreading of fabric is done by the spreading machine, where the 'Photo Electric Guides' are used to maintain uniform tension in the fabric, so that creases in the fabric is avoided during spreading, whereas in the MANUAL system it is unavoidable.
 - Cutters has an automatic sharpening device for knife, and raw-edge of the fabric do not fray out; As in manual cutting, which happens due to imperfect sharpening of knife.

Time taken for sample making

- Sample making is a continuous process in clothing industry during the development of a new product. The following steps are involved in the process:
 1. New material, design and processes have to be identified.
 2. The production of garment patterns has to be altered and perfected to rectify faults during making up of the sample.
 3. At the sample stage, the quantities of fabric and trimming are established and quick costing is made.
 4. The finished garment sample has to undergo scrutiny to evaluate whether they fit in the viability of producing the garment.
- In order to determine sample-making time, followed the process of sample making in both units. The following was the time taken:

Activity	Unit C (No of days)	Unit M (No of days)
New pattern creation alteration, grading, marking	1	3
Sourcing of materials	2	2
Production of sample	2	5
Total	5	10

Time taken for sample making:

- By using CAD Software and a Plotter it is easy to make sample. Sample making time was observed to be around 5 days using CAD system and about 10 days for manual.
- The CAD software helps designer of pattern to alter it easily in quick time. This is mainly due to collection planning CAD Software, which helps in:
 - Developing the variation from core design.
 - Trying the same cloth on a number of different designs.
 - Modifying some of the ideas to make the garment more acceptable to a wider range of customer.

With this flexible CAD System and plotter, CAD system is able to reduce 50% of sample making time compared to manual system.

- **Productivity:**

Productivity of Unit C & Unit M was obtained by taking into account per day production and monthly production capacity when similar sorts of garment were produced. The number of finished garment obtained each day as observed were as follows:

Per day productivity (Unit C) = 15,856 pieces

Per day productivity (Unit M) = 4,013 pieces

Day	Unit C (No of shirts/day)	Unit M (No of shirts/day)
1	16035	4235
2	15500	3850
3	16000	4150
4	16010	4008
5	15450	3750
6	16150	4150
7	15850	3950
<i>Per day productivity (Unit C) = 15,856 pieces</i>		
<i>Per day productivity (Unit M) = 4,013 pieces</i>		

- **Productivity:**

As mentioned in the experimental procedure, the CAD/CAM System has a production of 15,856 pieces/day whereas the MANUAL system has 4,013 pieces/day. Increasing monthly productivity by 75%.

- As the CAD/CAM process requires transfer of information or data for marker planning via floppy, the process is simplified and the production is increased.

- In CAD/CAM system, the capacity of the cutting room has to deal with a mixture of different types of cloth. Whereas in MANUAL system it is highly impossible to work with mixture of different types of cloth.

- With such a flexible cutting room facilities available, Unit C must have higher production rates compared with Unit M member together with very high cutting speed.

Lead time for production:

A typical product development cycle of a garment industry consists of the following steps:

- Designing
 - Marketing
 - Purchasing/production.
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- One has to compare lead-time of garment, taking into consideration the above-mentioned procedure in both Unit C and Unit M. The observed time required for each stage of procedure, details of the time taken in the two units are as follows:

Lead time for Unit C = 39 Days

Lead time for Unit M = 55 Days

Activity	Unit C (No of day)	Unit M (No of day)
Design plan, design collection	4	10
Design make pattern and sample	4	10
Marketing forward samples	20	20
Design grade samples	20	20
Purchasing order raw material	20	20
Purchasing raw material	5	5
Production	10	20
Total	39	55
<i>Lead time for Unit C = 39 Days</i>		
<i>Lead time for Unit M = 55 Days</i>		

- Lead-time of garment production is the number of days required to finish a garment from sample stage to finished garment. Lead-time during use of CAD system is about 39 days and a manual system is around 55 days. Reduction in lead-time up to 16 days.

This is due to:

- faster sample production,
- highly saved time and higher productivity combined with flexibility,