- **Hard copy output:**
Hard copy refers to the digital document file which is printed on paper or other material like transparency. In hard copy the output is printed on the paper and sometimes it is referred as permanent copy. We can touch the hard copy. We can say it is a physical copy.
For example- News Paper, Book, Notebook, printed document files, etc.

Advantages of hard copy include:

- o Durability: Hard copy documents are resistant to damage from electronic failures or power outages, and can be stored for long periods of time.
- o Accessibility: Hard copy documents can be read by anyone with access to the document, without requiring a computer or other electronic device.
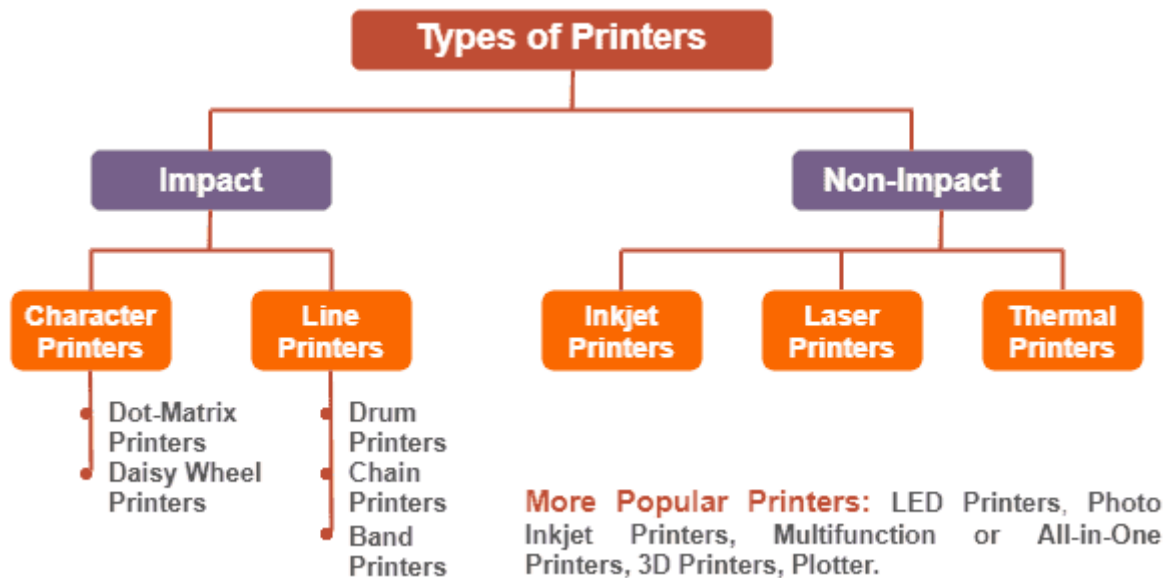- **Plotters:**
A plotter is a printer that interprets commands from a computer to make line drawings on paper with one or more automated pens. Unlike a regular printer, a plotter can draw continuous point-to-point lines directly from vector graphic files or commands.

Types of plotters include the following:

- o **Drum plotters**, which draw on paper wrapped around a drum that turns to produce one direction of the plot while the pens move to provide the other direction.
- o **Flatbed plotters**, which draw on paper placed on a flat surface.

- o **Electrostatic plotters**, which draw on negatively charged paper with positively charged toner.
- o **Inkjet plotters**, which use inkjet printer technology and coloured inkjet pens to deliver beads of ink in an assortment of colours to the drawing surface using vector graphic technology to move the pen plotters.

- **Impact printers:**

  Impact printers are printers that typically use a specific type of hammer with which the print heads are attached. When the print command is given, the hammer pushes the print heads onto the ink ribbon. Print heads have different characters, and therefore, they help the ink ribbon to draw the corresponding character on the paper that is placed near the ink ribbon.

  They are slow and mostly cannot print images hence they have become obsolete. However they cost less and therefore considered for bulk printing.

  Two types of impact printers are:

  1. Character printers: Character printers are defined as impact printers that typically print only one character at a time. That means, these printers use a single stroke of a hammer or print head at a time. That's why they are slow and cannot print the entire line at once.

They are further divided into 2 types:

a. Dot matrix Printers:

Dot matrix printers, also known as pin printers, are the most popular type of impact printer. These printers have a matrix of pins on their print heads to create character or graphics.

The more pins in a dot matrix printer, the faster the performance and better the print quality.

Dot-matrix printers are cheap and usually print 100-600 characters per second.

b. Daisy Wheel printers:

Daisy wheel printers are impact printer used primarily to achieve quality found with typewriters. Because these printers have a mechanism that looks like a daisy (a flower), they are named daisy wheel printers. More specifically, these printers have a disk that includes print heads and the ends of these print heads have a moulded metal character.

When the print command is given, the printer rotates the disk with all its associated characters. As soon as the desired character arrives at the correct print location, the hammer hits the disc and the corresponding character hits the ink to produce a character on a paper.

2. <u>Line printers:</u>

Line printers, also called bar printers, are defined as impact printers that usually print an entire line at a time. This means that these printers use multiple strokes of a hammer with different with different print head at once.

They are faster than character printers and can print up to 6000 lines per minutes.

Line printers are further categorized into following types:

a. Drum printers:

It consists of a rotating cylindrical drum with a circular band of characters on its surface. In particular, the surface is divided into tracks equal to the size of the supported printing paper. It has separate hammer for each set of characters.

When the print command is given, the drum rotates and when the desired character reaches under the hammer, the hammer quickly strikes the ink ribbon against the paper to print the corresponding character.

b. Chain printers:

The chain printers consists of a revolving chain with characters on its surface. These printers typically have a character set of 48, 64 or 96 characters. The chain is connected using gears in such a way that it can rotate horizontally.

When the print command is given, the chain rotates with its respective characters. As soon as the desired character reaches the correct print position, the hammer strikes the ink ribbon against the paper and the corresponding character on the chain.

- **Non-impact printers:**
  Non-impact printers have no hammer to hit the print heads on the ink ribbon. These types of printers do not even ink ribbon to produce prints. Instead they use various technologies.

Unlike impact printers, internal machinery components of non-impact printers typically do not make any direct contact with the paper.

Some categories of non-impact printers:

1. Inkjet printers:
   They are non-impact printers that are widely used by home users and small businesses. These printers make prints by spraying a pattern of ink droplets on the paper with help of a nozzle or jet.

2. Laser printers:
   Laser printers are non-impact printers, typically using laser or non-impact photocopier technology to produce dots needed to print text or images on paper. When the print command is given, the laser beam produces a text or image structure on a drum by controlling the electric charges.

3. Thermal printers:
   They use a specific heat-sensitive paper and they produce prints by pushing electrically heated pins onto the paper. The paper used in these printers has a special heat-sensitive coating.