Analytical Study for the Factors and Variations that Impact the Quality of Printing Advertisements in Printed Newspaper

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[i]Abstract

Several studies and research have been done in the field of print quality and print assessment, and repeatedly it has been concluded that it is a very complex issue. Often, printed matter, such as magazines and newspapers show variations in their print quality caused by a range of factors, and the competitive situation in the graphic arts and printing industry is an invitation to develop methods and procedures to limit these variations in the printing process.[i]

So the Specifications for Newsprint Advertising Production (SNAP) is designed to improve color reproduction quality on newsprint.[i]

Controlling and preparing advertisements for print reproduction requires an understanding of the relationship between design, prepress, and printing.

Keywords

advertising ,printed newspaper ,printing quality, Iso 12647

الملخص

تكمن مشكلة البحث في تدني جودة الصحف المطبوعة مما يؤثر بالتالي على جودة الإعلان المطبوع والذي يمثل أحد أهم الموارد المالية للمؤسسة الصحفية على الرغم من توفر المواد الجيدة والتكنولوجيا الحديثة، كما هدف البحث إلى تحليل العوامل والمتغيرات خلال مراحل إنتاج الصحيفة والتي تؤثر على جودة الإعلان المطبوع، وتحسين جودة الطباعة من خلال دراسة الأثر الناتج عن تطبيق أنظمة إدارة الألوان ومتطلبات المعيار (١٢٦٤٧:٣). تكمن أهمية البحث في أن الإعلان المطبوع يمثل أحد أهم الموارد المالية للمؤسسة الصحفية، وبالتالي يجب الاهتمام بجودة طباعة الصحف لجذب المزيد من العملاء للإعلان في الصحيفة المطبوعة. وفي إعداد البحث اتبع الباحثان المنهج التجريبي للتأكد من إمكانية تحقيق أهداف البحث بشكل عملي من خلال دراسة الأثر الناتج عن تطبيق أنظمة إدارة الألوان ومتطلبات المعيار (١٢٦٤٧:٣) كما استخدما المنهج الوصفي التحليلي لتحليل ووصف العوامل. لقد أجريت العديد من الدراسات والأبحاث في مجال جودة الطباعة وتقييم الطباعة، وقد خلصت مراراً وتكراراً إلى أنها قضية معقدة للغاية. وكثيراً ما تظهر المواد المطبوعة، مثل المجلات والصحف، اختلافات في جودة طباعتها بسبب مجموعة من العوامل، والوضع التنافسي.

الكلمات المفتاحية

الاعلانات الصحف، المطبوعة، الجودة الطباعية ، الايزو ١٢٦٤٧

• Importance of research:

1. There are still print media advertisements alongside electronic ones.

2. Importance of quality for color newspaper advertisements considering the competition with other media.
3. Newspaper printing is characterized by using a specific type of paper through which it is difficult to obtain print quality.

- **Research problems:**

1. The low quality of newspaper advertisements print media despite the availability of high technology machines and good materials.
2. There are increased defects and errors in newspaper printing activities in their various stages, which affects the printing quality.
3. Facing the competitiveness resulting from the prevailing digital transformation patterns in various fields.

- **Research Objectives:**

The purpose of this study is to:
1. Identify methodologies and procedures for print quality assessment in a color managed newspaper printing workflow and know how to approach.
2. Fulfill a color consistency for printed newspaper.
3. Raise the quality of newspaper advertisements using color management systems.

- Research Methodology**:**

The research takes the analytical descriptive approach to analyze and describe the color management systems and how it is used to print newspapers advertisements, to ensure the ability to achieve the research objective in a scientifical way,

- **Questions to be answered through the research:**

- How can this approach be used to improve newspaper advertisements printing quality considering the conditions of the existing competitive environment?
- What are the elements and requirements for the successful use of this approach?
- What are the expected results of the implementation of CMS in the newspaper advertisements printing sectors?

- **Research themes:** To achieve objectives of the research, the plan includes the following aspects:

o The theoretical studies present the most important methods of Color Management Systems in quality control of print newspaper advertisements.
o The Analytical aspect includes getting to know the printing process elements to achieve quality and standards according to the Specifications for Newsprint Advertising Production (SNAP) which is designed to improve color reproduction quality on newsprint.

First: Theoretical Aspect

1. Introduction

Global companies are working hard to improve the performance standards of the newsprint they produce which is affect the quality of advertising, (see figure 1), basic weight of the paper can be affected due to contact stresses resulting from compression from winding, which leads to

deformation of the paper, which expands to try to displace or get rid of those stresses. The rubber media - Blanket - is one of the factors that directly affect the quality of lithographic printing, as are the rest of the elements of the printing process such as ink, paper, dampening solutions and printing plates. The rubber media - Blanket -has many functions, as it absorbs printing shocks, receives ink and water without mixing them together and without affecting it by swelling, and then transfers the ink either as a solid area or mesh dots in a way that maintains the sharpness and cleanliness of the printing areas.

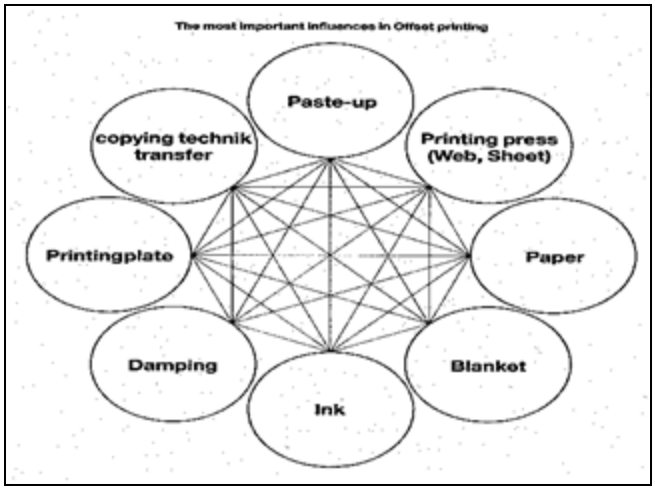

Figure (1): shows the most important elements of the printing process that affect the quality of newspaper printing.

2. Newspaper Printing presses:

A typical newspaper printing press is a web fed coldset offset press with closed loop controller system and monitoring. (see figure 2) The amount of ink deposited on the substrate is dependent on several parameters, and there are five key issues affecting the amount of ink deposited on the substrate an operator must deal with during a print run:

1. The size of the inked area. (The size of the inked area is job dependent and will not change during the print run).
2. The feed of ink.
3. The feed of dampening solution.
4. The substrate.
5. Environmental parameters, such as temperature and humidity.

The advertisements' quality in newspaper printing is constantly changing due to variations in the process. To reduce these quality changes, the operator must constantly monitor and control the process. Considering the high printing speed, the tension of ribbons and the large amount of color advertisements printed in modern newspapers. One realizes that it is very difficult for operators to achieve high quality level by monitoring and controlling the process manually. The solution is to put a system in the press for monitoring the print quality parameters inline or to control the process by a closed loop controller.

A densitometer is not well suited to put inline for two reasons. First, there is a problem of synchronizing the measurement with the print, a misalignment is not possible to be detected. Secondly, it is not possible to detect defects in the measuring area. Examples of defects are non-printed areas, dirt, and density variations in the printing area.[i]

A CCD-camera based imaging system is more suited for inline implementation. Such systems have the possibility to detect misalignment and adjust the measuring area accordingly. It is also possible to use such a system to detect defects in the measuring area.

The CCD-camera based calibration free technique allows to monitor the accuracy of halftone dot-sizes on the printing plates. The CCD-camera based calibration free technique also allows to estimate the approximate mechanical halftone dot-size on newsprint.

The color appearance values measured using a color CCD-camera based system provides an estimate of the amount of ink in a newspaper halftone print area for each separation.

The color appearance values integrate both the halftone dot-size and ink density. These values are easily interpreted by the press operator.[v]

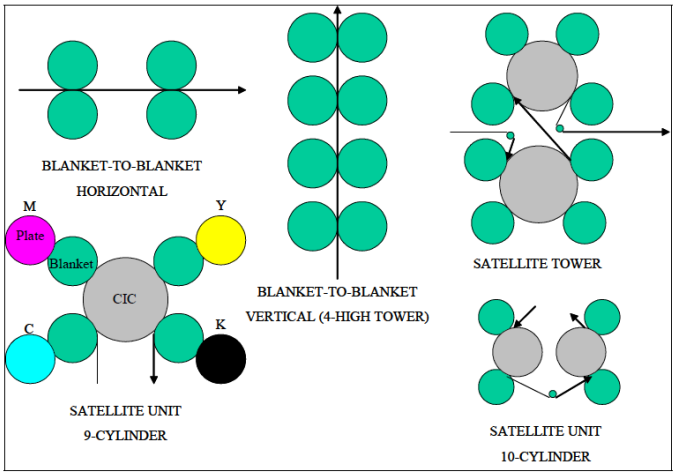

Figure (2): Common types of CSWO (Coldset web offset) printing units

2. 1 Newspaper Inks:

It was observed that the ultimate performance of the inks is dependent on many of the studied factors. The transparency, opacity and color properties of the inks can dictate the most appropriate ink sequence, which can then lead to an even larger enhancement of the color gamut of a specified ink set. Control over most of the printability properties can be exercised with the use of different substrate and ink types and better knowledge of the ink behavior on the press.

Transparency and opacity play a key role in the outcome of the gamut. The amount of trapping and the overall opacities of the trapped inks determine the amount of light that is reflected. The reflected light in turn affects the CIE L*a*b* values which play a key role in the measurement of the color gamut. The chroma values calculated from the overprint of the different ink sequences indicate that certain ink sequences produce more color saturation as compared to their counterparts. The chroma and saturation produce the finest printing results and provide the greatest color gamut[v]

3. Halftoning:

Halftone is the reprographic technique that simulates continuous tone imagery using dots, varying either in size, in shape or in spacing, thus generating a gradient like effect.

The process of converting the continuous image into the halftone image is referred to as screening or halftoning. Traditionally amplitude modulated or monospaced clustered single dot screens are used in newspaper printing. Each screen cell contains one single, often a round dot

that is size modulated. When tone values become high enough, approximately 50, the dot touches the cell boundaries and thus has to change the shape.

Coldset printing, such as newspaper printing, is especially sensitive to high amounts of ink because the ink drying relies on the fact that one or more components of the ink are transported into the bulk of the paper. Correct color reproduction requires that the inks are printed in the correct proportions.

o 3.1 Total Ink Coverage:

No printing process in the world allows the overprinting of cyan, magenta, yellow and black with 100 percent inking, which would correspond to a total ink coverage of 400 percent. Due to the nature of the materials concerned (ink and paper) as well as the method of drying, the total ink coverage is limited in every case. This is especially true of coldset newspaper printing, where the ink does not genuinely dry but only partially penetrates into the paper.

Excessive inking usually causes losses in quality that may only become apparent in the form of set-off smearing and in the mailroom when the products are rolled-up. Therefore, it is essential to limit the total ink coverage. The ISO 12647-3:2013 standard specifies that for newspaper printing, the total ink sum should not exceed 220%. That means that no part of the image – not even the darkest – has more inking than 220%.[v]

In the earlier standard, the recommendation for total ink coverage was 240%. As more and more newspaper printing plants are using lower gsm newsprint (40 and 42 g/m2), there is a necessity to lower the ink coverage. This market requirement is considered by the standard.[v]

o 3.2 Gray Component Replacement:

Gray component replacement (GCR) is a decisive means of reducing color fluctuations in printing and also saves on the ink cost. The advantage here is that we are printing with a lot less color ink without changing the color shade at all. This is the concept of GCR. The decisive point is that the increased use of black and reduced use of chromatic colors produces the identical color shade, while at the same time verifiably reducing the color fluctuations. This improves advertisements print quality and productivity because it reduces start-up time and waste as well, also saves on the ink cost.

Advertisements that are printed on newsprint have to be color separated with the ICC profile created specifically for this printing condition (WAN-IFRAnewspaper26v5.icc) by the color correction operators and automatic image processing software. In such cases, any other software that would modify the color numbers is not expected to modify the editorial pictures. The advantage is that whatever the color correction operators do to pictures, it goes right to the press, Bad Advertisements then become a responsibility of color correction operators and they get a chance to review their work and make improvements.

Further, the ISO newspaper profile is created with maximum GCR and it does not need further optimization for ink savings necessarily.

The printing process has so many variables that it does not allow target values to be reached exactly. For this reason, tolerance windows that must be observed. Thus ΔE1976 tolerances are given for the primary and secondary color targets. The deviation tolerance represents the

permissible deviation of the OK sheet from the original copy, and the variation tolerance defines the permissible fluctuation around the OK sheet.

Apart from ΔE1976, the ISO standard has also introduced, for information, tolerances based on ΔE2000. The ΔE 1976, which is a simple mathematical formula based on the distance between two points with x, y, z (or L* a* b*) co-ordinates. It can be easily calculated with an excel sheet or simply in mind. The Delta ΔE2000 is considered more accurate than the older formula but it is complicated to calculate. For process control, we believe that a simpler formula is much more useful and easier to understand. Hence, we recommend printers to still use the Delta ΔE1976 formula, especially because ΔE1976 is the normative way according to ISO 12647-3:2013 to be used for communication between printers and print buyers.

$\Delta E1976 = \sqrt{(L1-L2)^2 + (a1-a2)^2 + (b1-b2)^2}$ [i]

Table (1): ISO 12647-3: 2013 specification for screening

AM Screening	
Dot Shape	Ellipse
First dot link- up	40 percent
Second dot link- up	60 percent
Screen frequency	40 lines/cm to 54 lines/cm (100lines/inches to 140 lines/inches
Screen Angle	Cyan 15^0 Magenta 75^0 Yellow 0^0 Black 135^0
FM screen dot size	40 µm : 10 µm

Where continuous tone imagery contains an infinite range of colors or greys, the halftone process reduces visual reproductions to an image that is printed with only one color of ink, in dots of differing size.

The separation process breaks down the image into tiny dots that are printed in specific angles on the paper to reproduce the original image. All four colors have different printing angles called screen angles that can be adjusted.

There are two basic methods for Halftoning, the threshold matrix (Dot Matrix) and the lookup table.

The separations are used to produce four different image carriers (plates), these plates are used to print the image, but the image is reproduced with halftone dots and not as a continuous tone image.

4. Print media

Print media properties are essential factors from the point of view of ink and paper interaction and for achieving desirable color matching quality and reproducibility.

Paper is an absorbent substrate, which absorbs printing ink to a certain extent. Since untreated newsprint can allow excessive penetration of ink, coatings are applied to hold the colorant near the surface for achieving high color density and minimizing strikethrough. The paper coating is

a composite material consisting of pigment, binder and small amounts of performance enhancing additives along with air-filled voids.

Combinations of ink and media have a significant impact on color gamut and color stability of the printed files and predetermine color gamut and color stability of the final printed products.[x] (see figure 3).

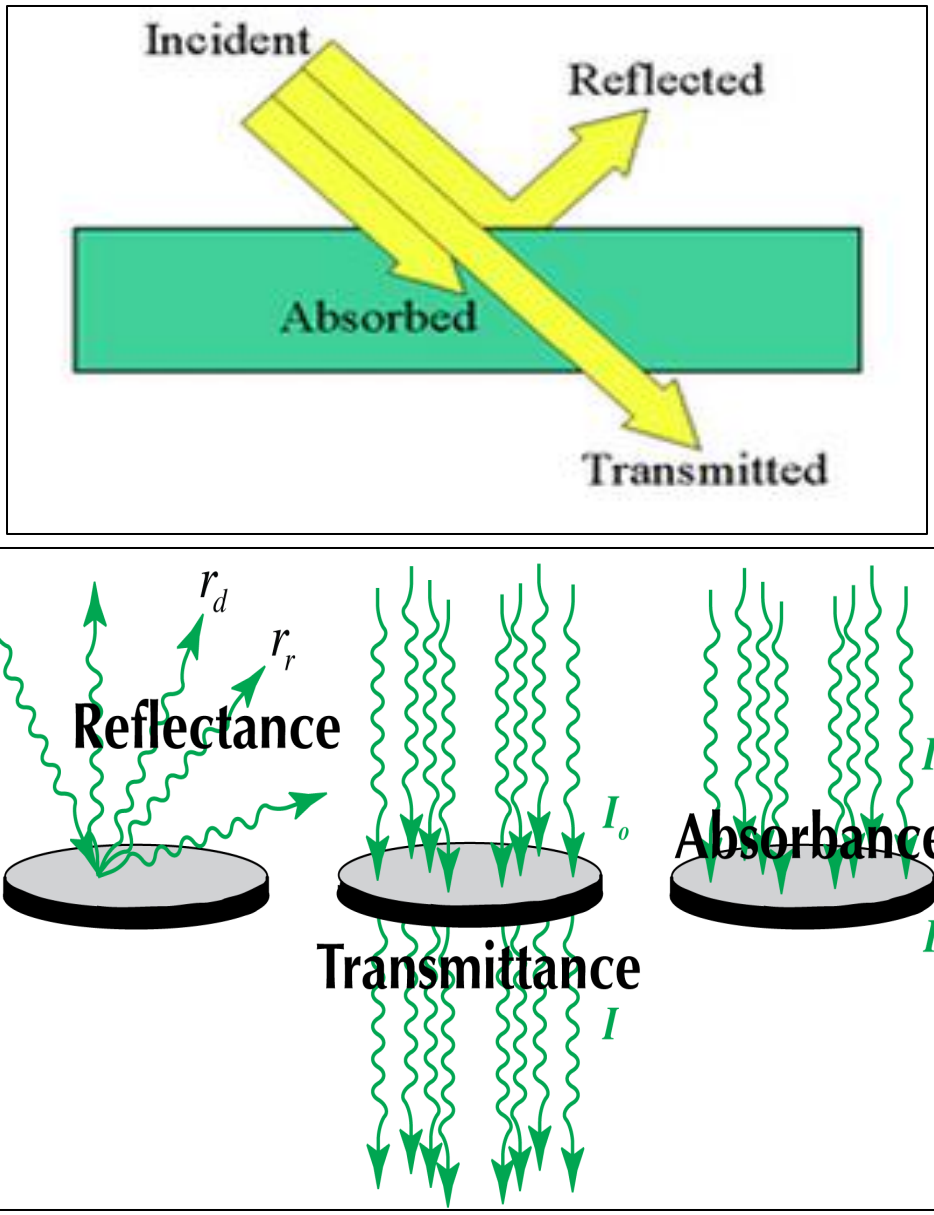

Figure (3): The interaction of light and matter

The characteristics that affect the color perception process on the printed matter, which is difficult to match on a computer display or colored proof media, are Gloss, Texture, Absorbency, Fluorescence.

The reflection of light from a colored surface has two components: (see figure 4)

1. Some light is reflected unchanged from the first layer of the surface.
2. The remainder enters the substrate and undergoes scattering and multiple reflections inside the material.

Eventually, unless the light energy decays within the material, it emerges from the surface as a diffuse reflection. Where the light meets a pigment particle within the surface, some wavelengths will be absorbed while others will be reflected and allowed to continue their path through the material. Any light that emerges will be perceived by an observer as having color corresponding to the wavelengths.

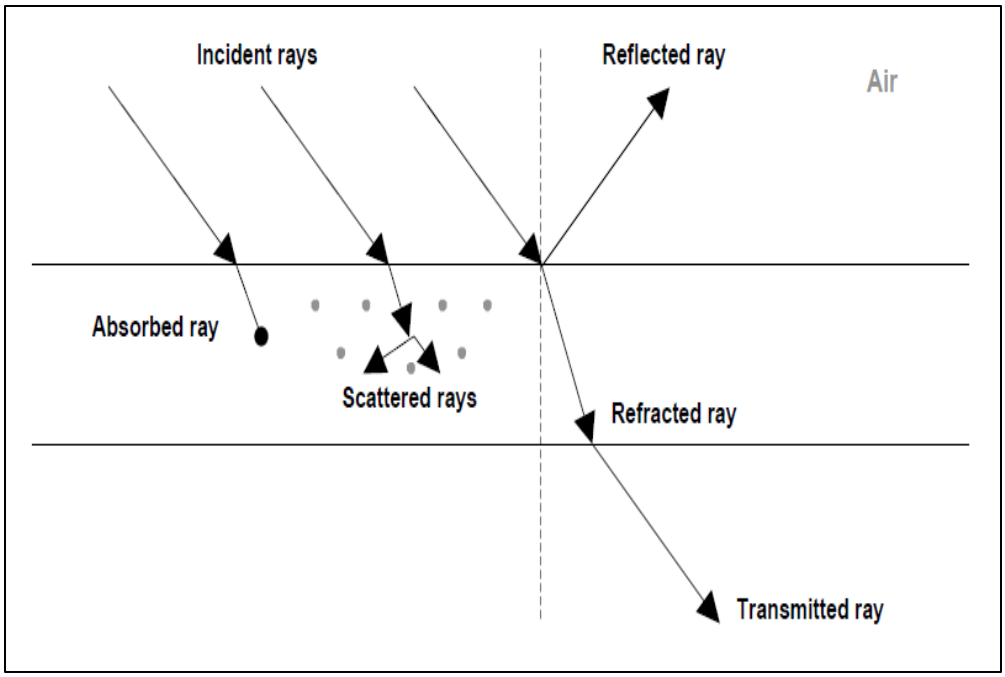

Figure (4): The reflection of light from different print media

The light that is reflected from the first layer of the surface (the first-surface reflection) makes the surface appear lighter, since light has been reflected without any part of it being absorbed. This effect is known as flare.[x]

Newspaper printing is usually done on newsprint by using a set of process colors CMYK, additive secondary or subtractive primary colors plus black.[x]

The pigment particles are bound together by binder in a porous mesh. Their arrangement on the base paper makes up the coating structure. Changes in pigment composition, type and amount of binder and additives produce different coating layer microstructures. The coating structure in turn affects ink setting speed and ink layer uniformity, which are important in achieving high print quality. Technically, the coating layer provides two primarily functions: To absorb the ink vehicles and to control the ink spreading and penetration.[x]

The physical properties, such as roughness and porosity, affect ink penetration, ink spreading, absorption, the final color matching quality and detail rendering quality.[x]

The ink receptivity determines the ink interaction with the paper. The coating layer on the surface can help to attain better control on absorbency of ink. Absorbency of ink is determined by the smoothness or roughness of the surface of the substrate, pore size or porosity and structure as well as its surface energy. [x]

Low porosity and low surface roughness results in lower absorbency of the ink and higher ink holdout, thus the outcome is glossy print along with high print density. Alternatively, high roughness yields more ink absorbency that results in more penetration of ink vehicle into the pores, giving a dull and matte finish to the print. Coating layer significantly affects properties,

such as gloss, Optical density, dot shape, image brightness, color, drying time of ink and it's compatibility with surface of the substrate.[x]

Newsprint is a crucial variable in predicting and reproducing color and has significant influence on the print quality such as print contrast, density, color, and tonal range.

The interaction between paper and ink, its porosity, surface smoothness, together with optical properties such as whiteness, opacity, light scattering, and gloss must be considered in the printing process.[x]

It substantially affects the light fastness of the print, specifically in the case when fluorescent agents are present in the coatings.

Optical brightening agents (OBA) are additives used in paper coatings to enhance the brightness appearance of coated and uncoated papers.

These OBA absorb from the UV portion of the light and reflect the light in the blue portion of the visible spectrum increasing the brightness of paper. So, these optical brightening agents play a critical role in color reproduction and hence must be taken into consideration. For assessing the possible effects of fluorescent component there are instruments containing an optional UV absorbing filter that deals with the fluorescent contribution of the substrate.

Selection of paper with suitable properties is important to achieve better quality prints. This selected paper should reproduce fine details by reproducing a good range of tone scales. By using enhanced quality media, high optical density, better stability of color, an exceptional color gamut can be achieved.[x]

Ink set off can occur when an image total ink levels has been exceeded. Typical newsprint can absorb 220% combination of ink before it stops absorbing ink and will cause it to imprint a reverse image on the opposing page.[x]

5. Advertisements on newsprint

Print media is a very commonly used medium of advertising by businessman. It includes advertising through newspaper, magazines, journals, etc. and is also called press advertising.

Advertising revenue forms a substantial portion in revenue generation for a print media, and thus forming advertising an integral part of any publication. Each publication has its readership influenced by its image, which is formed by the editorial content, news and the entertainment offered by a publication. The better this advertisement, the greater is the acceptance of the advertising message by a reader. Brand Recall is a direct function of the impact made by the advertisements.[x]

Print media is still one of the best ways to remain in touch with consumers. A long shelf life of a newspaper and magazine facilitate the advertiser to communicate with the readers' leisurely. The adage 'a picture speaks a thousand words', holds true here since consumers can see how the product looks like. A reader tends to linger on at a good visual. If important, the reader can also cut the advertisement for future reference.

- **Advantages of advertisements in Newspaper are as below:**

1. Wide audience reach: Newspapers can reach a diverse audience.
2. Local targeting: Useful for businesses with a localized customer base.
3. Credibility and trust: Readers trust newspaper content.
4. Tangibility and longevity: Physical presence and lasting impact.

5. Flexible ad placement: Advertisers can choose where to place their ads.
6. Cost-effective option: Newspapers offer affordability for various budgets.[x]

6. Color management:

The human eye can see color gamut wider than any equipment does like scanner, digital camera, monitor, printers. (see figure 5) We can represent the color reproduction process by funnel, where color reproduction possibilities reduced from input process to printing. This means colors that we get are shrunk.

The available color gamut of a particular device such as a monitor or a printer is different. A monitor which displays RGB signals typically has a greater color gamut than a printer which uses CMYK inks. When a color is "out of gamut," it cannot be properly converted to the target device. So, Digital instruments deal with colors different from printers thoroughly. While digital instruments use additive colors system, unlike printers use subtractive colors system.[x]

Hence, the purpose of color management process is determined from old English adage "what you see is what you print".

Basic idea of the application is to meet the need of open-systems and cross-media color reproduction workflows with the goal of maintaining color appearance. The International Color Consortium (ICC) committee standardizes the ICC profile structure for describing input and output devices.

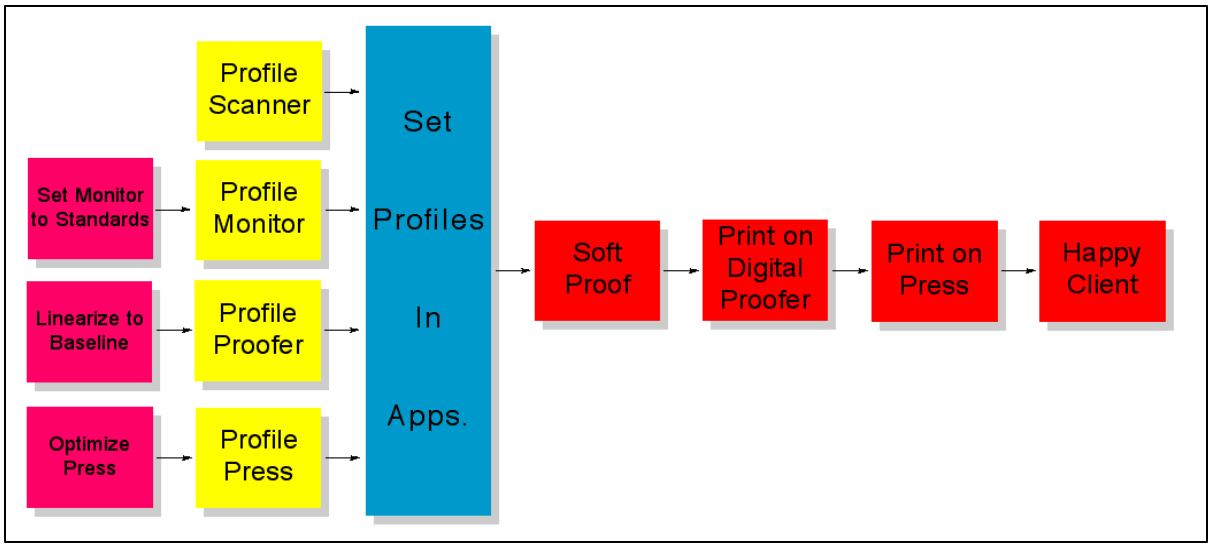

Figure (5): Calibration vs. Linearization (Baseline) vs. Characterization in color management[x]

We use Color Management software to create profiles for all your devices, a profile provides a description of each device's color gamut or the range of reproducible color.[x] .

o 6.1 Principles of ICC Color Management:

The basic aim of color management (in the graphic arts industry) is to ensure color accuracy throughout the entire workflow from initial draft through the finished printed product.[x]

Color Management is a way to set up a workflow to allow all these devices to speak the same language so you can get accurate and predictable results. The ultimate goal is to match the colors of the image displayed on your monitor with the ones produced by your printer.[x]

(see figure 6)

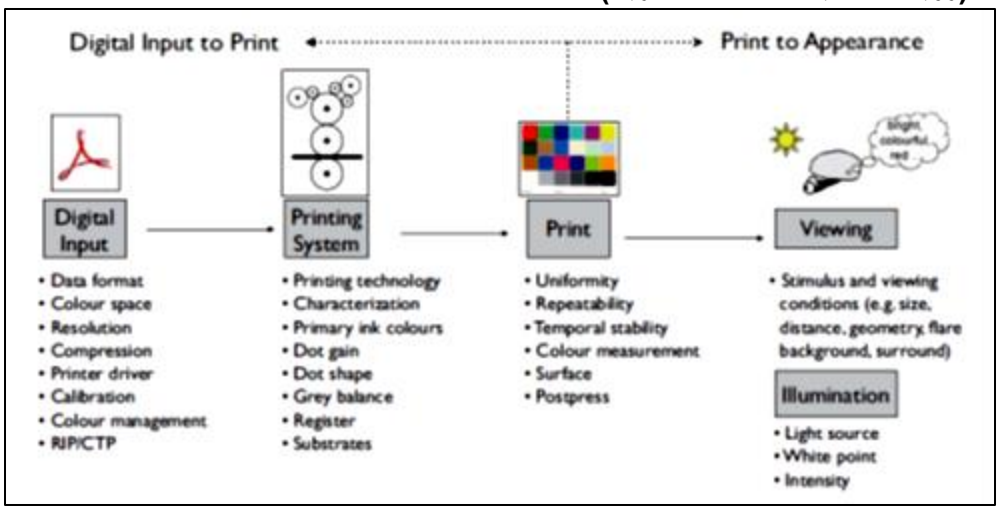

Figure (6): From digital input to print appearance

You use these profiles in your workflow, and the result is an accurate translation from one device to the next, giving you consistent, predictable color.[x]

The basic principles of good quality color reproduction are the following:

l. Correct mapping of critical reference colors such as sky, foliage and skin tones. This may not mean an exact match but simply that the reproduced color is not grossly wrong. For example, almost any shade of blue will produce a satisfactory sky: Even shades of purple would be fine, but green is clearly wrong.

2. Correct mapping of white and neutral colors that constitute the gray axis or the new axis which runs from black to white. These colors should look neutral; else the image will have an overall color cast, or an overall color tint.

3. Control of the tone reproduction involves mapping of the overall contrast and brightness. Image reproduction often involves tone compression. The goal is to reproduce, as possible at all levels of brightness throughout the image while maintaining a correct overall appearance

4. Control of the overall colorfulness so that the image does not look washed out or gaudy.

5. Control of sharpness, texture and other visual artifacts that contribute to image appearance.[x]

6.2 ICC profiles as part of a color reproduction system:

Simply using a CMM that only supports the basic ICC architecture to calculate and apply the transformation from input device space to output device space does not necessarily provide a color reproduction system that suits all needs.

So long as the application providing the CMM allows the selection of the appropriate rendering intents at the time the appropriate profiles are combined, there are many market sectors where it is perfectly adequate – particularly where input devices are 'smart'. However, there are other markets where it may not be. In such situations additional functionality needs to be provided by the color management vendor.

7. Image editing:

One issue is that many captured images for advertisements are not ideal. They frequently exhibit color casts, limited dynamic range, or poor tonal rendition, which may not be obvious on some

media but will be when reproduced on others. Such 'errors' need correcting during the process of reproduction. Algorithms for automatically optimizing digital images have been developed, and are a part of many captured images, color management or editing applications. In fact, they may often be applied without the user knowing. However, because of the subjective nature of color reproduction such automatic algorithms may not suit every user, or every image. Thus, for high quality imaging, unless the user is confident in the quality of captured images, every image should be assessed and corrected as necessary.[x]

Such corrections require a subjective assessment of the image, which means that it has to be rendered in some form to judge its quality, though for some high-quality applications the image is first rendered in its final form, which implies some sort of iterative correction process.

Each ICC profile is defined for a specific combination of device and media (as appropriate) and as such, when used appropriately, should enable faithful reproduction of the colorimetry of the encoded image. Although the perceptual and saturation rendering intents include optimizations for media and viewing condition differences, device profiles – which are determined independently of any images - do not apply image specific optimizations. Where precision is of the utmost importance color management software can be designed to update device profiles to also include image corrections, but because of the subjective nature of this correction it is usually sensible, in the view of many experts, to keep the characterization and image enhancement algorithms conceptually separate. Alternatively, the algorithms for image correction, if automated, can be applied at the same time as the media transform specified by the device profile and as "smart" CMMs (which add functionality by interpreting both profile and image information in calculating the reproduction transformation) are developed such procedures are very likely. [x]

An input profile can be embedded in an image or sent as a separate file. Either way it can be used to define the intended color as already stated. However, the sender of the file has to be responsible for ensuring that the correct profile is embedded, but equally importantly has the responsibility for ensuring that the image is pleasing. If the image needs correction this should be undertaken prior to sending it, either by directly editing the image or the profile. In the event that this has not been done, and it is the responsibility of the receiver to optimize the image to make it good, this must be made clear when the image is sent. The sender of the file must then be prepared to accept the changes made or ensure a proofing cycle that will enable corrections to be specified is part of the workflow.

8. Color gamut compiler:

Color gamut is a range of colors achievable on a given color reproduction medium (or present in an image on that medium) under a given set of viewing conditions – it is a volume in color space. The color gamut of an image or color reproduction medium can be represented in a three-dimensional color space such as CIEXYZ or CIELAB.

It is to try to get the best compatibility between different devices, even when they look in non-harmony. And if a device has a color gamut larger than the other devices, Color values will be converted, so some of them will be lost due to the inability of the second device to produce them.[x]

This phenomenon occurs roughly every color compiler process between devices. That means, it is impossible to reproduce desired color precisely, so the first objective of the color management module to access closer the best tonal values can be reached.

8.1A Compiler process for Color gamut:

It's a connection between a specific color gamut and reference color, thereby, the original image must be converted to match a particular output device, although there is a difference between the color gamut and color characteristics of each color system.

For example, digital colors input process (RGB values of the scanner) are attributed to the similar values of reference color system or independent color System. (see figure 7)

Color management systems utilize the CIELAB as a reference color system. and the Color compiler process is based on a set of important principles:

1. Maintaining the gray axes of the image.
2. Maximize contrast in image lightness
3. Many colors are not out of gamma limits.
4. Minimize any color deviations in saturation or hue.[x]

To achieve this goal, it is necessary to map the color reproduction characteristics of each input and output color reproduction medium within the device independent color space (CIEXYZ or CIELAB) and to store this information in ICC color profiles. Thus, the final color of the print can be simulated at any stage in the production workflow.[x]

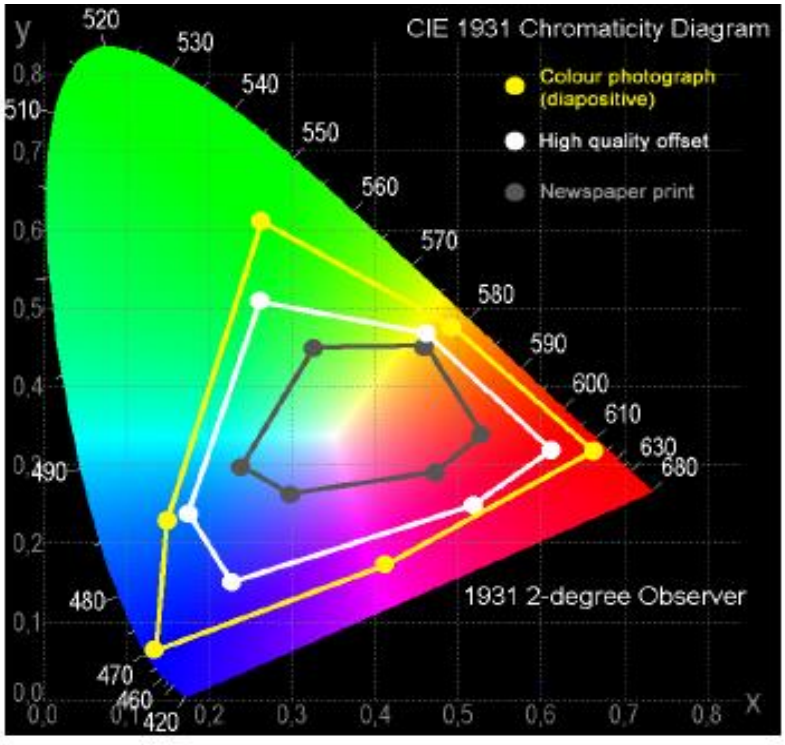

Figure (7): Color Gamut's in the CIELAB color space for difference reproduction processes. Yellow – color photograph (diapositive), White – High quality offset printing, Gray – Newspaper printing

9. Newspaper quality aspects:

There are nine aspects of color printing quality, divided into four appearance factors and five valued by customers. (see figure 8)

Appearance factors:

1. Conformance to specifications: This factor refers to how closely the final product conforms to pre-defined tolerances in terms of density or color targets and registration goals.

2. Technical excellence: Concerns the physical and psychophysical properties of color reproduction. Tone and color reproduction, image definition, interference patterns and surface characteristics are the main components of this aspect of quality. The printing conditions, the characteristic of the original, and the specific instructions or demands influence the optimal values for these attributes.

3. Aesthetics: It refers to the creative decisions made by the photographer or graphic designer to express their message in the advertising or fashion illustration business. Printers as such do not have significant influence on the aesthetic aspect of quality.

4. Permanence: It is related to the ability of the substrate and inks to resist environmental influence of light, chemicals, and moisture. Overprint varnishes or coatings can also influence the permanence.

The non-appearance aspects: Of color printing quality are related to customer service, production, logistics, and economics. Recently, a new quality label of graphic arts. Recently offset and newspaper printing have adopted uniform standards including parameters and tolerances and process control systems developed by a number of research and standard groups such as ISO (International Standardization Organization), aiming to stabilize and monitor the production processes.[x]

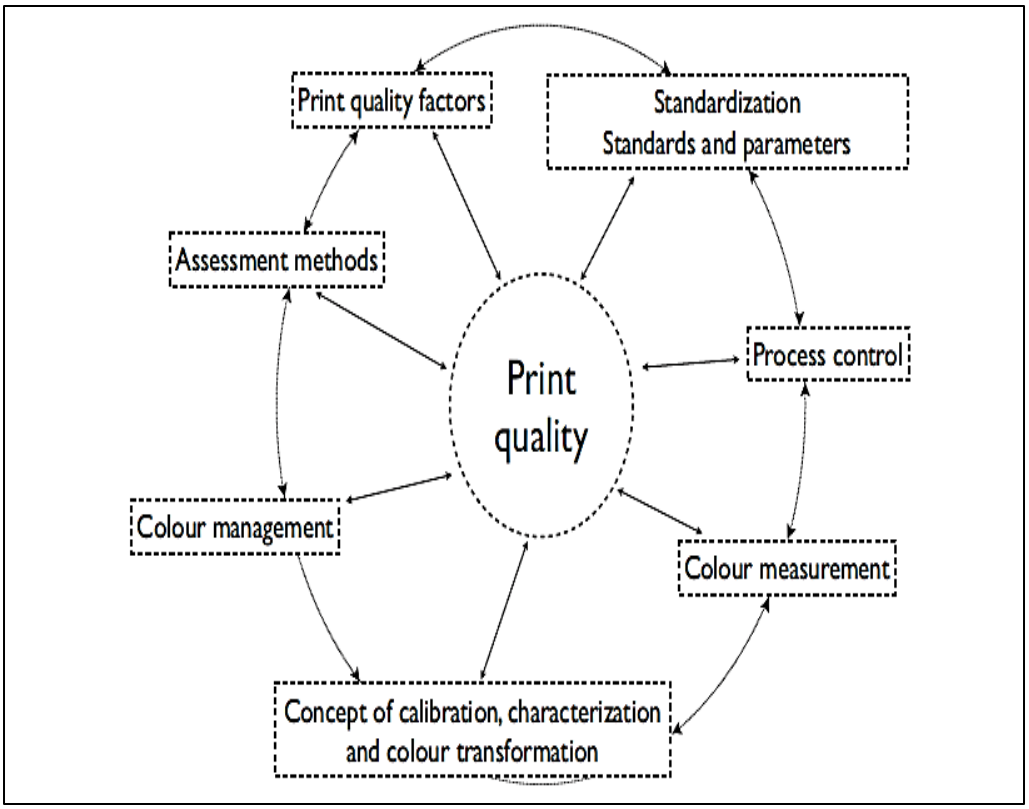

Figure (8): Aspects and factors affecting and contributing to print quality

9.1Factors Contributing to Print Quality:

In terms of conventional printing the instructions from the printer driver are sent via a raster imaging processor (RIP) to the computer to plate (CTP) system where the printing plate or image carrier is the material by which ink is transferred to the printing substrate. The final print, when viewed in a certain environment under a certain light source, results in a certain appearance for a viewer.

1. Calibration - The process of ensuring that all color production devices (scanners, monitors, printers) conform to an established state, specified by the manufacturer, user, or an industry wide specification or standard. [x]

2. Linearization - A specific type of calibration in which an output device is adjusted to deliver a straight-line relationship between input and output. For example, an imagesetter is linearized to output halftone dot values within a certain tolerance of those input. You Linearize by doing a Baseline Calibration on the Iris 2/4 Print.

3. Characterization - It is a way of determining how an input device captures color or an output device records color when it is calibrated. This is the process of creating an ICC Profile.[x]

Substrate is a crucial variable in predicting and reproducing color and has significant influence on the print quality such as print contrast, density, color, and tonal range. The interaction between paper and ink, its porosity, surface smoothness, together with optical properties such as whiteness, opacity, light scattering, and gloss must be considered in the printing process. [x]

Then deals with various factors that determine print quality such as printing technology, colorant/media interaction, geometric resolution, halftoning, separation, black generation, under color removal (UCR), grey component replacement (GCR) and tone reproduction. refers to factors of influence and specifications determining the quality of print and is dividing the production process into the components “prepress”, “print”, postpress”, and “material”. Each component has multiple factors influencing the print quality.

Second: Analytical study

A. Analytical study

1. Newsprint

Newsprint Pulp is made of soft woods, which is either ground wood (GWD) or mechanical thermal pulp (TMP) or Kraft tree pulp, Newsprint consists of many components, including:

-Cellulose (unbranched particles and long chains) by 42% ± 2%.
-Skeletal polysaccharides
-Hemi-celluloses (branched molecules with short chains) by 27% ± 2%.
-Matrix of polysaccharides.
-Lignin (a network of three-dimensional phenolic polymers) by 28% ± 3%.
-Other extractives by 3% ± 2.

Newsprint fibers are mechanical or recycled pulp or a mixture of mechanical pulp, chemical pulp and recycled pulp, due to environmental legislative reasons, economic considerations or to acquire some good printing characteristics or better tensile and durability specifications .

1.1- Basic general properties of a newsprint:

The shade and brightness of newsprint vary; these variations influence printed ink hues and overprints. The SNAP specifications are based on materials that were printed on newsprint with

the characteristics below. If the substrate being used is substantially different from these reference values, adjustments to SNAP specifications may be necessary to achieve desired results.

-Base weight used: 45 g / m2.

-Fiber length: 0.3 mm.

-Tensile strength in the longitudinal direction (Machine Direction "M. D" so that the minimum tensile strength in the longitudinal direction is 1.8 N/mm2.

-Porosity (Bentson scale) ranges between 713 - 782 mm / minute as the surface porosity is to measure the rate of air passage through the chick indicated in millimeters / minute, the higher the flow rate the porosity is high, which is a factor that does not affect offset printing .

-Opacity: It is the measurement of the ability of paper to hide printed elements on one side from the other, and is calculated as a percentage of the reflected values from one sheet placed on a black background once, and a package of the same type of paper again and ranging between 90-92.5% .

-Oil absorption (g/m2) within 5 seconds - Top Side ranges from 15-35, and Wire Side ranges from 20-35 .

-Elongation %: minimum 0.9%.

-Smoothness (Bekk scale) 50 ± 0.5 seconds.

-Thickness (thickness) ranges between 78.8 - 85.5 microns.

-Component size (Bulk) maximum 1.60 cm 3 / g.

-Density is a maximum of 0.60 g / cm3.

-Shade is bluish± 0.15 a = - 0.35 3.5 ± 0.5 b

The shade and brightness of newsprint vary. These variations influence printed ink hues and overprints. The SNAP specifications are based on materials that were printed on newsprint with the characteristics below. If the substrate being used is substantially different from these reference values, adjustments to SNAP specifications may be necessary to achieve desired results.

, Reference Values for Substrate

	L*	a*	b*
SNAP Stock	82.0	0	3

Tolerances for the colour of the print substrate

	ΔL*	Δa*	Δb*
Proofing should be within	3	2	2
Production should be within	3	1	1
Production shall be within	4	2	2

L*, a*, b* and brightness measured according to 4.3.1.1 of ISO 12647-3 (2° observer, illuminant D_{50}, 45°/0° or 0°/45°, black backing).

2. Newspaper printing inks

Cold-set inks are characterized by the nature of penetration dryness, and they consist of resins, colorants and additives are included in the composition of these inks to obtain a high coverage degree and viscosity stability.

Offset inks conforming to NAA and SNAP specifications are made using the following pigments:

Cyan: Phthalocyanine blue (green shade)

Magenta: Rubine red

Yellow: Diarylide yellow

Black: Furnace black (blue shade)

Table (2): CIE L*. A*. B* Aim Values

CIE Lab L* a* b* Aim Value			
	L*	a*	b*
Cayn	57	-23	-27
Magenta	54	44	-2
Yellow	78	-3	58
Black	36	1	4
Cayn - Yellow	53	-34	17
Cayn - Magenta	41	7	-22
Cayn - Yellow	52	41	25

Values come from ISO 12647-3. They represent offset inks and paper only. Data for flexographic were not available at the time of publishing. Measurements are according to ISO 13655 (2^0 obse illuminant D... $45^0/0^0$ or $0^0/45^0$, black backing).

	K	C	M	Y
Deviation Tolerance	5	5	5	5
Variation Tolerance	4	4	4	5
	Not more than 60 % of the total deviation or variation shall be attributable to either ΔL^* or ΔH^*			
	a Deviation and variation tolerances are defined in ISO 12647-1			

The technical specifications of the inks vary according to many factors, the most important of which are the type of newsprint, the color sequence, the number of inking cylinders, the speed of the printing machine, the method and quality dampening solution used, in addition to the quality of the inking system … etc.

Transparent inks are used to print newspapers, as they are characterized by:

A - Viscosity: 40 - 50 Pa / s.

B - Yield value: 900 - 1200 dyne / cm2.

C - Flow: 6-8 cm / 15 minutes.

D - Tack: 15 units - Tack units.

E - Dispersion (granule distribution) Dispersion: 0.2 -0.4 µm.

F - Grain smoothness (grinding degree): 65% part >45 microns.

G - Boiling temperature: 200.°

H- Ignition point: 280°

Table (3): Input and Output Resolution (Snap Recommendation)

Recommended Aims for Ink Solid Density		
Dry Solid Ink Density(SID)	Offset Newspapers	Offset Commercial
Cayn	0.90	0.95

Magenta	0.90	0.95
Yellow	0.85	0.90
Black	+/- 1.05	+/- 1.10
Tolerance	+/- 0.05	+/- 0.10
(Dry SID Status T densities measured as absolute; paper density included)		

3. Design of color control bars used on newsprint:

A - Integrated network gradations for each color printing separately (for example, two grades for each color. The first gradient is ten steps, each step represents 10% more than the previous step, the second gradient is also ten steps, but each step includes two gradients, the difference between them is 5%).

The purpose of these gradients is the possibility of measuring the area of the dots percentage of each halftones spots to obtain the characteristic curve so that we can make the compensatory curve for RIP devices to identify the fingerprint of the printing machine in terms of the thickness of the ink film as well as the dot gain caused by the mechanical variables of the printing machine and the available color range. (see figure 9)

B - The standard digital color bar which contains solid spots to measure the density of inks and halftones spots with percentages to determine dot gain through specific spots to measure dot gain in halftone spots 40% and 80%, in addition to determine the slur spots, and the accuracy of registration. There are color spots with only two basic colors to determine ink trapping as well as a greyscale to measure gray balance using the three standard inks (Cyan – Magenta – Yellow) and also greyscales using black ink only, in order to compare them to achieve a good color balance for print media.

Figure (9): A printed digital test form on newsprint

3.1- Basic print quality properties in newspaper printing:

1. **Density**: A measure of the amount of ink placed on paper, and the thicker the layer of ink, the higher the density.

2. **Dot gain**: A measure of the difference in the area of the standard mesh point and the point produced on the print at 25%, 50% and 75%.

Table (4): Dogain /TVI measurement ay different tonal value

Dot 25% Gain/ TVI @	Offset (85 - 100) LPI
Cayn	24 %
Magenta	24 %
Yellow	24 %
Black	24 %
Tolerance	+/- 3%
Dot 50% Gain/ TVI @	Offset (85 - 100) LPI
Cayn	26 %
Magenta	26 %
Yellow	26 %
Black	26 %

Tolerance	+/- 4%
Dot 75% Gain/ TVI @	Offset (85 - 100) LPI
Cayn	17 %
Magenta	17 %
Yellow	17 %
Black	17 %
Tolerance	+/- 3%

Note: Dogain /TVI values are based on average of over 200 SNAP certified printers

3. **Characteristic curve**: It is the relationship between the required halftone percentages and those produced on the final print, and the four operational colors (cyan, magenta, yellow, black) are measured at halftone spots%٧٠ ,%٨٠ ,%٩٠ ,%١٠٠) ,%١٠ ,%٢٠ ,%٣٠ ,%٤٠ ,%٥٠ ,%٦٠) .

4. Contrast: It is a measure of the ability of the printing process to carry details of shadow areas, as it compares the solid density area to the halftone density area on spots, usually a spot of 75% in the range from zero to 100%).

5. Trapping: It is the adhesion rate of an ink layer on another pre-printed ink layer, and the process of ink splitting depends mainly on the rheological properties of the ink, and for this reason, wet ink on wet ink (Wet-on-wet) is considered in printing techniques the tacking of the next ink is lower than the previous ink.

6. Gray Balance : It is a comparative relationship between the three main operational inks CMY and a neutral grey halftone of the printing system; to obtain a correct grey balance, it is necessary to control the dot gain values of the three basic operational colors (C, M, and Y) where a balance must be made between the tonal value increase and the tonal value decrease bout core value.

Table (5) offset 3-C gray Balance

Offset 3 –c Gray Balance				Black Tint Equivalent	Aim Density of three – Color Patch
C	M	Y	K	K	
25 %	18 %	18 %	0 %	25 %(Quartertone)	0.52 +/- 0.05 %
40 %	30 %	30 %	0 %	50 %(Midtone)	0.65 +/- 0.05 %

6.1 Color Balance Considerations

Changes in dot gain values among the various colors can lead to color balance problems. If dot gain values stray too far from the values noted above, the relationship among the colors can be seriously damaged. Color balance is typically evaluated at the 50% dot area. While the dot gain tolerance for any given color is +/- 4% in the 50% dot area table, the values for each color should not differ from each other by more than 4%. For example, if cyan is 2 percentage points above the recommended value, then yellow should not be more than 2 percent *below* its recommended value. Otherwise, the spread between the two colors would exceed 4 percentage points and color balance would be adversely affected

7. Grey component: It determines the difference in the grey scale between printed ink and theoretically ideal ink, it is a scale from zero to 100.

8. Gamut range: It is all colors that can be produced using a combination of different inks printed on a specific material (for example newsprint) and a specific press as well.

The scientific results show the difference from the standard color range CIE l*a*b, where the horizontal axis represents the colors from green (-a*) to red (+a*), while the vertical axis represents the colors from blue (-b*) to yellow (*+b), and the lighting axis (L*) represents the range from zero % (expressed black) below the axis to 100% expressed as white at the top of the axis.

Figure (10): Gretag Mac Beth Spectro Eye for printing measurements on paper

3.2- Input and Output Resolution

Resolution--both for input devices and for output devices--is an important consideration in the printing process. Several measurements are used to describe image characteristics in the process:

- Gray Steps = $(dpi / lpi)^2$
- (Intended Output Size Ratio) x (Screen Ruling) x 2 = (Minimum Scanning Resolution)

Table (6): Input and Output Resolution (Snap Recommendation)

LPI	DPI								
72	900								
85	1016								
100	1200								
133	1600	Minimum Input Scan	(PPI)	144	170	200	266	300	400
200	2400	Output Image	(LPI)	72	85	100	133	150	200

Conclusion

The purpose of this study is to identify methodologies and procedures for print quality assessment in a color managed newspaper printing workflow and know how to approach. Fulfill a color consistency for printed newspaper, and raise the quality of newspaper advertisements using color management systems; using the analytical descriptive approach to analyze and describe the color management systems and how it is used to print newspapers advertisements, to ensure the ability to achieve the research objective in a scientifical way .To achieve consistent color advertising reproduction in newspapers delivered, SNAP has developed standards and guidelines for coldset reproduction on newsprint (uncoated groundwood papers) and workflow best practices to maximize print quality. The SNAP Guidelines are intended for newsprint substrates.

B. Findings:

1. There are many advantages of advertisements in printed newspapers than electronic newspapers that require considering their quality.
2. The press organizations have followed the accelerated developments in the world of modern printing techniques, as its printing presses have taken their largest share of the modern needs that were available to them to keep pace with the requirements of the international press at this time.
3. There are many systems to control press production processes, as they share a common goal, but differ in the system, as modern printing systems cover an infinite number of complex production methods and various newspaper forms to achieve the high-quality requirements of advertisers.
4. Color Management is a way to set up your workflow to allow all devices to speak the same language, so you can get accurate and predictable results in newspaper printing.
5. To achieve consistent color advertising reproduction in newspapers delivered, SNAP has developed standards and guidelines for coldset reproduction on newsprint (uncoated groundwood papers) and workflow best practices to maximize print quality. The SNAP Guidelines are intended for newsprint substrates.

C. Recommendations

1. Using color management systems in newspaper printing by applying Color characteristics files of printing output with ink type and paper used in production due to ensure accurate color reproduction as much as possible as specified in the digital file for the image and not just as it looks on the screen. This is verified not by the eye but by specialized measuring devices.
2. Necessity of using SNAP (specifications for newsprint advertising production) to improve color reproduction quality on newsprint, communicate standards and best practices for print reproduction and proofing, and provides guidelines for the exchange of information between advertisers, advertising agencies, publishers, pre-press managers, material suppliers, and commercial and newspaper printers.

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