



CRITICAL ANALYSIS OF BASIC QUALITY FACTORS IN DIGITAL ENHANCEMENT PRINTING PRESSES & EXPLORATION OF VARIOUS POSSIBILITIES TOWARDS IMPROVEMENT OF THESE QUALITY ATTRIBUTES

Ravin^{1*}

Article History:

Received: 25/10/2022

Published: 30/12/2022

Accepted: 05/11/2022

Abstract

Digital printing technology is becoming popular day by day and the recent growth rate of this particular printing sector is quite good. Due to the numerous offerings in comparison to the conventional printing techniques, digital printing is capturing the marketplace once it was in the domain of conventional printing technologies. Print buyers and consumers are getting attracted towards this printing system because of quick turn-around time, print on demand, shorter run job characteristics and cost effectiveness of the final printed products coupled with range of digital printing enhancement options for making the final printing output unique and attractive in the targeted printing segments. This research is aimed at finding the gap and the effectiveness of the various digital enhancement presses available in the market place and their effects on different printing substrates. Sincere effort is made to surface the gap in terms of printing quality of two most commonly used digital enhancement presses and indicating possible solutions towards producing high quality digitally enhanced printing products.

Keywords:- Digital printing, analog printing, printing quality, digital enhancement, printing output, print enhancement, commercial printer.

^{1*}M. Tech. Research Scholar, Department of Printing Technology, Guru Jambheshwar University of Science & Technology, Hisar-125001, Haryana, India

***Corresponding Author: -** Ravin

*M. Tech. Research Scholar, Department of Printing Technology, Guru Jambheshwar University of Science & Technology, Hisar-125001, Haryana, India

DOI: -10.53555/ecb/2022.11.12.197

Introduction

Digital printing has created its own place in the printing industry, since 1995, catering to a wide range of applications especially suiting to short run printing jobs coupled with print on demand and shorter turnaround time. With the passage of time, it has improved in terms of final printing quality and adding some other facilities to complement the printed output. These are popularly known as the digital enhancement techniques. In the marketplace these points are being appreciated by the print consumers and print buyers. In order to stay competitive in the industry and cost effective, digital presses with enhancement techniques are getting utmost attention for producing high quality printing with unique enhancements for niche printing market. As the print buyers are demanding high quality printed products, especially in packaging applications, these presses are becoming an integral part of the printing industry.

A growing opportunity in today's time for digital print enhancement is presenting customers with print work that's embellished or enhanced with special effects produced on digital presses or finishing equipment. Commercial printers, converters/ packaging printers, publication printers, and in-house printing operations all stand to make the most of offering customers print products that embrace noticeable special effects. Many types of embellishments, like extended-gamut colours, specialty colours, foiling, embossing, and specialty coating, aren't new. But, the mastery to provide them on digital devices is making them affordable to marketers and brand owners, while also offering new products earlier on insufferable (Ming He and Liping Zheng (2017).

With digital print, there are also many associated advantages, including the ability to produce affordable short runs and turn them around quickly. Personalization, either as true one-to-one, or in segmented or targeted use, is another key advantage. Capabilities like print on demand, just-in-time manufacturing, and the ability to use the digital printer as a virtual document repository also separate digital print from conventional methods like offset. These capabilities bring with them supply chain advantages that can contribute to extremely effective operations in a cost-driven strategy, not to mention the value they bring to customers (Kye-Si Kwon Et Al., 2020).

The special effects that can be achieved with a digital enhancement press breathes new excitement into print media and moves the printer and buyer away from a conversation centred around price, and toward one centred around unique capabilities and processes (Marin, 2023). Applying enhancements to printed materials has opened up a world of new possibilities. And since setup costs are minimized, the application of the effects is less expensive, which is especially important for shorter runs. Also, because some of these finishing techniques are 100% digital, the effects can be incorporated with VDP. This creates an opportunity to apply customized enhancements to print where every product produced is different (Christos Trochoutsos Et Al., 2020).

There are two primary digital enhancement presses technology used in the printing industry to achieve various effects and enhance the quality of printed materials; Scodix and MGI Jet Varnish. Scodix is a leading provider of digital enhancement presses and finishing systems. Their printing machines utilize a proprietary technology called Scodix Sense™, which enables the application of a range of tactile effects and enhancements to printed materials. MGI is a renowned manufacturer of digital printing and finishing solutions. Their machines are designed to provide high-quality, personalized printing capabilities with added special effects (Ole Norberg Et Al., 2001).

MGI's flagship technology is called "Digital Enhancement" (DE), which combines digital printing and post-press finishing in a single process. With MGI's machines, users can apply spot varnishes, foil stamping, embossing, and 3D textures to enhance printed materials. MGI's solutions cater to various industries, including commercial printing, packaging, labels, photo books, and more. It can also be used to create a variety of effects, including spot varnishing, 3D relief, and hot foil stamping (Berculescu Et Al., 2019).

Of all of these, quality factors (such as extended colour gamut and the use of spot colours) plus a range of enhancements (such as white, coatings, textures, security, metallics, fluorescents) are the aspects of print enhancement that contribute most to a value driven strategy. Print enhancements are typically used for premium products, to demonstrate standout print capabilities, to be the foundation for design excellence, and as factor in competitive differentiation. Nevertheless, it is

important to remember that a special colour or texture can help highlight a URL, bar code, or other connection to virtual that might otherwise be overlooked (Huailin Li Et Al., 2021).



Figure 1, Scodix Before & After (Justin Bousquin Et Al., 2011)

Review of literature

Depending on the solution used, many of these effects can be applied in one pass, in-line with four-color process, or off-line using a separate hardware solution. Because these enhancement techniques are 100% digital, any of these effects can be incorporated with variable data printing (VDP), something that just wasn't possible a few short years ago (Patil, 2011). With the help of CCD digital printing quality detection and analysis technology, it can carry out rapid evaluation and objective detection of printing quality, and can play a certain control effect on printing quality. It can be said CDD digital printing quality testing and analysis of the rational application of technology, its digital printing and printing materials for a variety of printing equipment to improve the quality of a very positive role. In this paper, we do an in-depth study and discussion based on the CCD digital print quality testing and analysis technology (Ming He Et Al., 2019).

Digital Printing has been established as one of the most rapidly evolving printing processes since its first introduction in 1982. In the years that followed, digital printing became the one significant new technology for print media production. Digital printing is continuously changing the print media landscape. Although, DP creates structural changes in production workflow and processes, it lacks in terms of print standardization, compared to offset printing for example, where consistent aim values and guidelines apply by means of ISO 12647-2 (Cheng, 2020).

An important way to determine if prints are qualified is to evaluate the printing quality. The system used to measure printing quality for gravure ornamental paper is not ideal, though. In order to address this issue, a method for assessing the quality of ornamental paper based on the entropy weight method (EWM) model and the analytical hierarchy process (AHP) is suggested in this study (Berculescu Et Al., 2019).

Digital printing technology has advanced significantly alongside China's ongoing information technology advancement. It has had positive economic and social benefits and has also been widely used in China's printing sector. However, there are still a lot of issues with how digital printing technology is applied. As a result, the essential reform and optimisation of the current digital printing technology must be carried out on the basis of this research by the appropriate technical professionals. The status quo and advancement of digital printing technology are primarily examined in this essay (Berculescu Et Al., 2019).

Research problem

In the recent times, printing enhancement techniques are becoming popular in the marketplace to take care of high-end printing requirements. In the present situation printing establishments are trying hard to remain in the market by offering numerous innovative options, so that they can be better positioned in the particular category. The printing quality of presses like the SCODIX ULTRA PRO202 and MGI digital print enhancement presses are of greater importance for producing high quality printed output for the growth and development of printing industry as a whole. As the technology is in the early stage of development, lot of challenges are likely to come onto the surface and hence needs critical study in the areas of printing quality with relation to the surface characteristics of printing substrates, this will help to reduce the possible gap of high-quality final printing output.

Research objectives

The objective of the above research work was to compare the printing quality difference between two most frequently used digital printing enhancement presses; SCODIX ULTRA PRO202 and MGI, while printing on different printing substrate media. To finding the surface quality attributes of different printing substrates and the relationship between the surface characteristics of substrates with that of the various attained

printing quality enhancement points. At the end, it was aimed at pointing out various possible solutions for further enhancing the printing towards high end printing output and solutions.

Research methodology

Two highly popular digital printing enhancement presses; SCODIX ULTRA PRO202 and MGI were identified and selected for their high-end printing output characteristics for accommodating a wide range digital printing enhancement printing product. These two presses are quite popular in the Indian printing industry for their consistent printing quality coupled with high quality printing enhancement capabilities. Two types of printing substrates; ART CARD 300 grammage basis weight and 275 MICRON MGI: NTR Synthetic Sheet Paper were selected among the available printing substrates for printing and digital enhancement operations. Fifty each of the

above printing substrates were taken into research work purpose and they were printed with suitable images for supporting the research work.

Data collection & analysis

Test samples were created and prepared by printing the job on the selected two printing substrates taken into research. The test samples were measured to determine their physical properties; thickness, weight, and tensile strength. The results of the measurements were compared to the specifications for the job. This was aimed at identifying the potential areas where the job may not able to meet the specifications. Based on the results of the tests, recommendations are made for improving the digital printing and enhancement factors. The physical properties like weight, thickness, brightness, opacity, smoothness, colour, sharpness and ink absorption were tested.

Table 1, Scodix Ultra Pro 202 Machine Poly Sense Consumption

Poly Sense Consumption Test			
Sr. No.	Variales	Scodix Ultra Pro 202	Poly Sense Consumption At 40 Micron
1	Point Lines		24.55%
2	Text		27.68%
3	Solid		90.01%
4	Pattern 1		12.56%
5	Pattern 2		11.68%
6	Pattern 3		10.09%
7	Pattern 4		12.27%
8	Pattern 5		13.06%

Table 2, MGI Varnish 3D One Machine Poly Sense Consumption

Poly Sense Consumption Test			
Sr. No.	Variales	MGI Jet Varnish 3D One	Poly Sense Consumption At 40 Micron
1	Point Lines		24.55%
2	Text		27.68%
3	Solid		90.01%
4	Pattern 1		12.56%
5	Pattern 2		11.68%
6	Pattern 3		10.09%
7	Pattern 4		12.27%
8	Pattern 5		13.06%

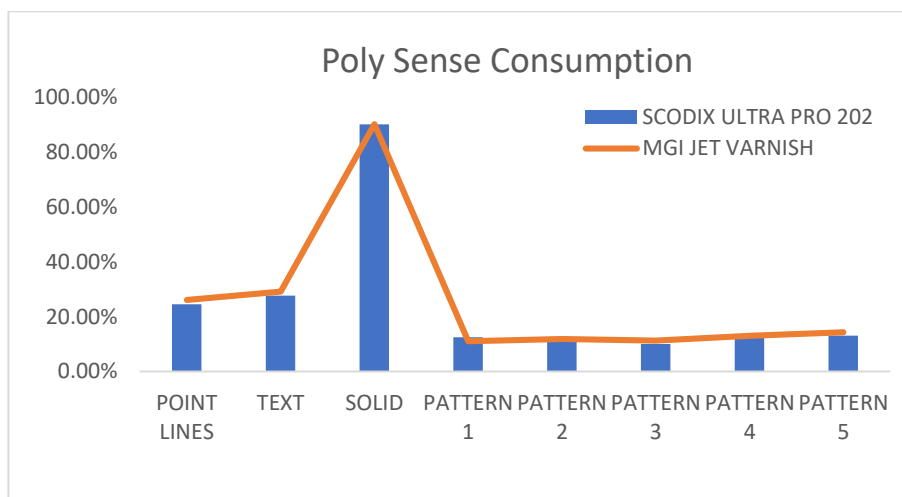


Figure 2, Comparison of Poly Sense Consumption between Scodix Ultra Pro 202 and MGI Varnish 3D One

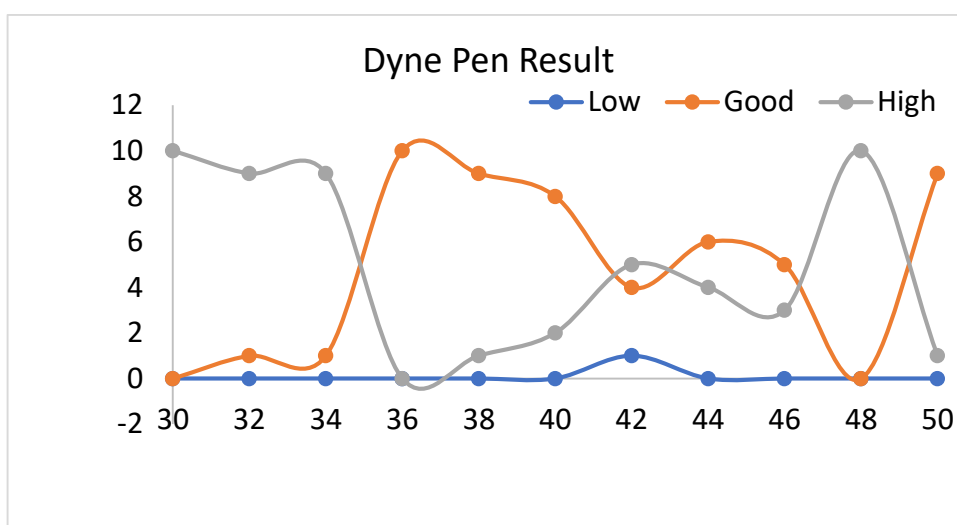


Figure 3, Comparison of Dyne Pen Test Result for MGI Varnish 3D One Machine on Art Card 300 GSM Paper.

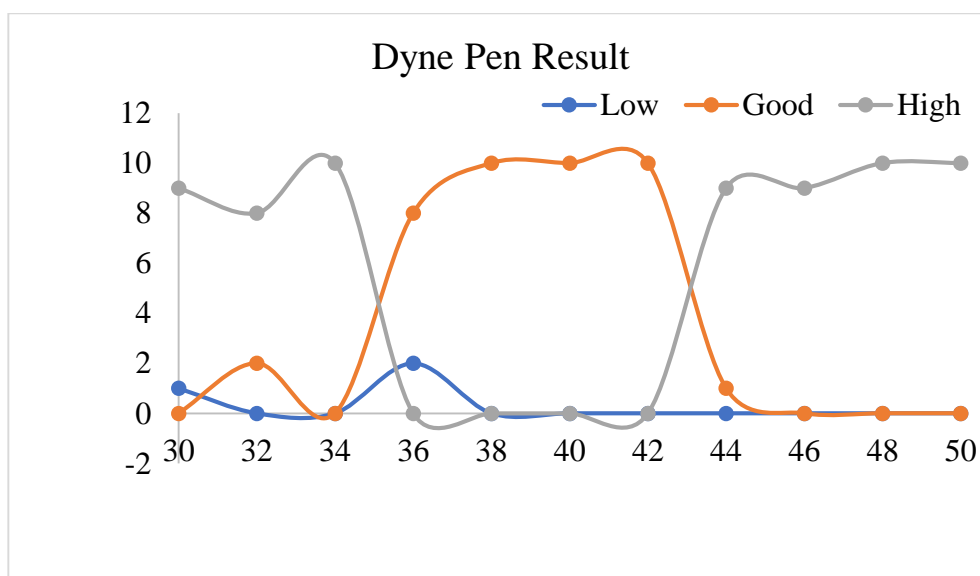


Figure 4, Comparison of Dyne Pen Test Result for Scodix Ultra Pro 202 Machine on Art Card 300 GSM Paper.

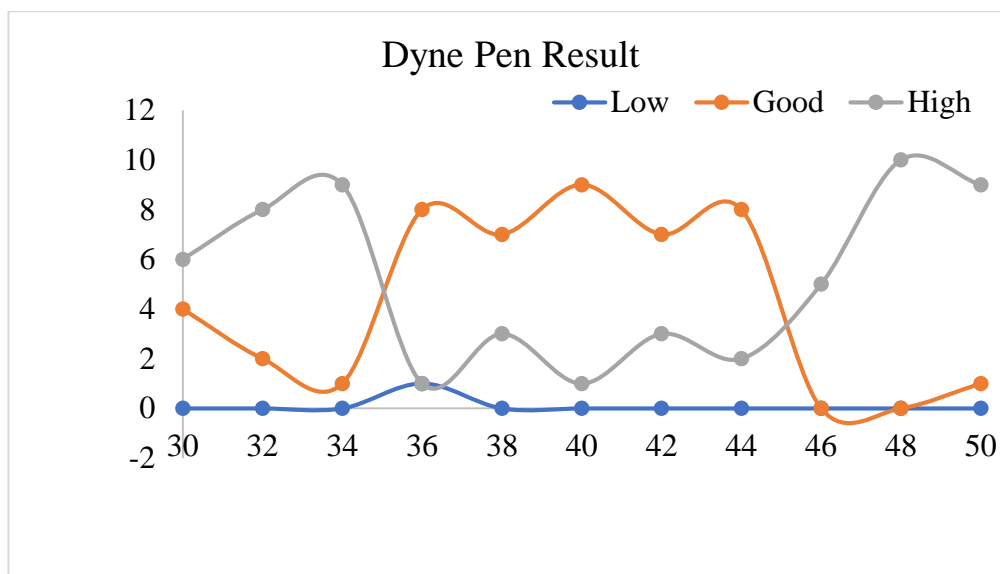


Figure 5, Comparison of Dyne Pen Test Result for MGI Varnish 3D One Machine on NTR Synthetic sheet Paper.

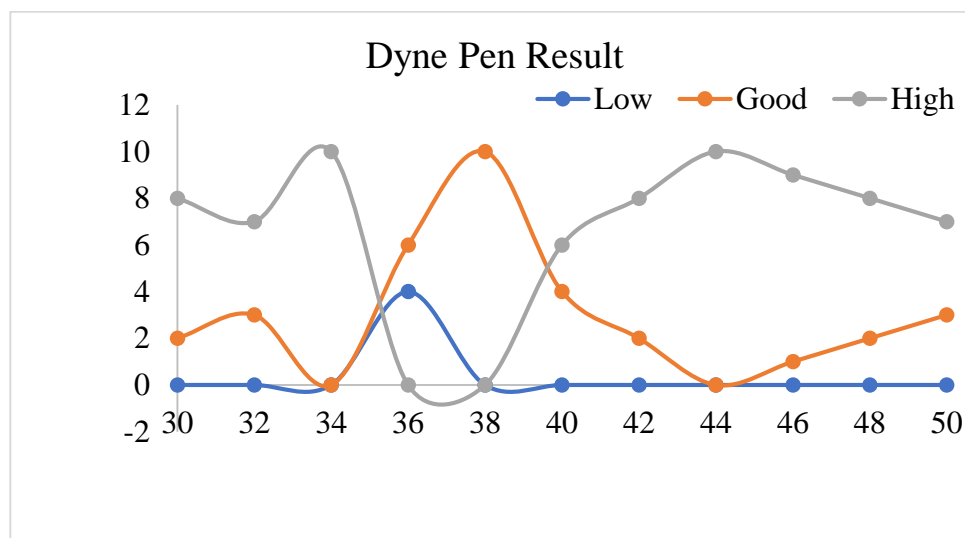


Figure 6, Comparison of Dyne Pen Test Result for Scodix Ultra Pro 202 Machine on NTR Synthetic sheet Paper.

Various tables and graphs presented above indicates the polysense consumption and Dyne pen test results of the two printing substrates used for the two digital printing enhancement presses taken into consideration. These reading were taken under the controlled environment which is being followed by the industry set-up for obtaining the optimum results.

Result & discussions

Poly Sense Consumption Test: Scodix Polysense consumption is less than MGI in all areas, including point lines, text, solid area enhancement, and overall pattern. This means that Scodix is more cost-effective in terms of polysense consumption than MGI. Point lines: Scodix uses less Polysense to create point

lines than MGI. This is because Scodix's technology is more precise and can create thinner, more refined lines. Text: Scodix also uses less Polysense to create text than MGI. This is because Scodix's technology can create sharper, more defined text.

Solid area enhancement: Scodix uses less Polysense to enhance solid areas than MGI. This is because Scodix's technology can create more uniform, consistent coverage. Overall pattern: Scodix uses less Polysense to create overall patterns than MGI. This is because Scodix's technology can create more complex, intricate patterns with greater precision. Overall, Scodix is a more cost-effective solution for polysense printing than MGI. This is because

Scodix uses less Polysense to create all types of printed materials, including point lines, text, solid area enhancement, and overall patterns.

Dyne Pen Test: The dyne pen test results showed that dyne values of 36, 38, 40, and 42 had more samples with good surface tension. This means that these dyne values are ideal for digital print enhancement for all types of designs, including solid, text, lines, and patterns. The test was conducted on both Scodix Ultra Pro 202 and MGI machines using a variety of paper types. The results showed that any paper type with a dyne value between 36 and 42 will produce fine results when used with either machine. Overall, the dyne pen test results suggest that Scodix Ultra Pro 202 and MGI are both capable of producing high-quality enhancement prints for all types of designs. However, paper types with a dyne value between 36 and 42 will produce the best results.

Conclusion

Two digital print enhancement presses taken into the particular research work are the two mostly used presses in the printing industry for their high-end printing and enhancement results. As the printing market is penetrating into food, cosmetics, pharmaceutical and agriculture-based packaging printing, which demands for a wide array of printing enhancement options, demands for such types of digital printing enhancement techniques are being noticed in the printing industry and it has certainly a bright future in the coming days also. From the above research work, it is quite evident that, the printing quality of digital printing presses are quite good and a very line gap is observed between the selected two digital printing enhancement presses.

As the technological and application part is quite new, there is a lot of scope of improvements in the coming years, so as to produce optimum level of digital printing and enhancement activities. Printing industry is evolving and over the years it has successfully absorbed and accommodated various innovative technologies and techniques for providing high quality printing coupled with print enhancements for taking care of high-end printing applications.

References

1. Ming He and Liping Zheng (2017) "Digital Printing Quality Detection and Analysis

Technology Based on Ccd", Earth and Environmental Science, Vol. 100, 012098, 2017.

2. Kye-Si Kwon Et Al. (2020) "Review of Digital Printing Technologies for Electronic Materials", Flexible and Printed Electronics, Vol. 5, 043003, 2020.
3. Christos Trochoutsos Et Al. (2020) "Developments in Digital Print Standardization", International Symposium on Graphic Engineering and Design, Page No. 395-406, 2020.
4. Ole Norberg Et Al. (2001) "A Comparison of Print Quality Between Digital and Traditional Technologies", International Conference on Digital Production Printing and Industrial Applications, 2001.
5. Teemu Leinonen, Marjo Virnes and Iida Hietala and Jaana Brinck (2020) "3D Printing in The Wild: Adopting Digital Fabrication in Elementary School Education", International Journal of Art & Design Education, 14768070, Page No. 600-615, 2020.
6. Liviu Berculescu Et Al. (2019) "Efficiency Analysis of Implementing Hybrid Printing Technologies" Matec, Web of Conferences 290, 2019.
7. Justin Bousquin Et Al. (2011) "Life Cycle Analysis in The Printing Industry: A Review", Picrm, 2011.
8. Caroline Kalombe And Jackson Phiri (2019) "Impact of Online Media on Print Media in Developing Countries", Open Journal of Business and Management, Vol. 7, Page No. 1983-1998, 2019.
9. Huailin Li Et Al. (2021) "Research on Printing Quality Evaluation of Decorative Paper Based on Ahpewm Model", Jrm, Vol. 10, Page No. 3425-3438, 2021.
10. Dhanshri M. Patil (2011) "Recent Trends of Print Media in Development Communication", Global Media Journal, Vol.2 No 2, Page No. 1-20, 2011.
11. Ming He Et Al. (2019) "Research on The Status Quo And Development of Digital Printing Technology", Cisat, Conf. Series 1168, 022037, 2019.
12. Fayou Cheng (2020) "Application Analysis of Digital Printing Technology in Packaging Printing", Iceeb, E3S Web of Conferences 185, 02034, 2020.