

The Newsprint Physical Properties Impact on Run-ability & Productivity (Application on CSWO)

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Abstract:

Run-ability was measured in several studies as a break ratio of quantity rolls for a specific mill. However, The Productivity is defined as the ratio of output to input.

Newsprint Physical Properties' importance is to raise machine productivity by minimizing the break ratio and keeping paper flow uniformity during the production run.

The problem of this study that the Newsprint properties' deviations are considered the obstacle of maintaining the Run-ability; especially there are a lot of newsprint mill are used in the Egyptian newspaper market.

The purpose is to determine the Newsprint physical properties' impact on the run-ability and the productivity. The experimental comparative methodology has been used in this study that applied on four different mill of ordinary newsprint. The experiments were applied on cold set web offset press called (Color man S)

Results refer to: All of paper thickness, water absorbency, roughness and moisture content have the most effect on run-ability as well as the tensile and the elongation deviations effect on productivity.

Keywords:

Newsprint, Run-ability, Break ratio, Cold Set Web Offset, Unplanned stop, Elongation

1. Introduction:

Earlier studies have shown that the press configuration and newspaper structure have an impact on the productivity of production process ⁽⁶⁾, the average production speed decreases with the higher number of pages and with lower quantities ⁽¹⁾.

There is a certain relationship between paper characteristics and web breaks ⁽³⁾. The unplanned stops, down time and exist technology effect on the efficiency. The waste of the total product is considered as an indicator of the effectiveness ⁽⁵⁾.

Measuring the productivity requires fixed conditions, materials and method of information flow ⁽⁵⁾.

Web break is an important runnability issue in the pressrooms. Statistics for a large number of rolls are required to determine the runnability with a reasonable level of confidence ⁽⁸⁾.

Break ratio can't only express run-ability, tension defects and wrinkling but also it may be happened because of unplanned stops as mentioned in several studies ⁽¹⁰⁾.

In the present study, I suppose that many physical properties have an effect on Run-ability, similarly and Productivity. Experimental tests were applied on cold set web offset press (Color man S) at constant production conditions and enough repetitions.

Research Problem

Following of the insufficient criteria in the selection of the properties of newsprint; specially, physical properties deviations, in the Egyptian newspaper presses, cause several run-ability defects, due to less productivity.

Objective

The aim of this study is to achieve the best run-ability at newspaper presses in the Egyptian market by getting correct parameters of choosing newsprint, understanding the impact of physical properties on run-ability and productivity enables us to reach the target.

Methodology

This study used experimental method to determine the impact of the physical properties on printing quality elements. The experimental work employed a practical comparative between four kinds of newsprint mill. The measured data was recorded and organized to facilitate subsequent analysis.

2. Research work:

2.1 Literature Survey

Cold Set Web Offset (CSWO) is commonly used in the in Egyptian newspaper presses, by using ordinary newsprint, which is an absorbent and unsized substrate. According to the wider range of newsprint that has been used in the Egyptian presses, it is not easy to get a constant level of run-ability due to the newsprint properties variances.

Specifications standard commitment for newsprint has a vital role in increasing the run-ability and the high level of the machine's productivity; from several perspectives such as: successful reel splices, fit registration, less paper waste, identical web tension and continuing of running at variant speed ⁽¹⁴⁾.

Run-ability of newsprint is considered to be a correlated with Productivity. Also, we can evaluate every matter separately. Run ability could be calculated as the break ratio of one hundred paper roll (breaks which caused of paper). Productivity is defined as a ratio of actual production to planned production at specific time ⁽³⁾.

For measuring Newspaper Run-ability, as the size of experimental samples is large as the results are confirmed. It is notable, Productivity has affected by products run length and actual operations time.

It is assumed that, the physical properties of newsprints affect both Run-ability and Productivity⁽¹¹⁾, so the following experiments will compare between the properties of each paper mill and its performance on the press.

2. 2 Experimental Work

2.2.1 Materials

Test has been applied on cold set offset press (Color man S) by using four newsprint mill 45 gm/m² as following: Western mill (Holmen, Norske skog) & Eastern mill (Solikamsk, Kondopoga). Tests and measurements were applied on the following four newsprint mill listed in table. 1

	mill	batch no
H	Holmen	30803185
N	Norske skog	4448292
K	Kondopoga	22085850
S	Solikamsk	20647897

2.2.2 Procedures

Physical and mechanical tests were measured according to ISO test methods listed in table 2

Basis weight	ISO 536
Thickness	ISO 534
Tensile	ISO 1924/2
Elongation	ISO 1924/2
Roughness Bendtsen	ISO 8791/2
Moisture content	ISO 287
Water absorbency	ISO 535

Printing conditions: cold set offset press, Color man S, 1996 and all printing trials were conducted at stable and constant operation conditions except a type of paper mill, as follows:

- Constant ink/ water balance, at the same speed and the same printing unit
- Coldest news ink: Flint (EUROSTAR OR S), Color sequence: CMYK
- Dampening solution Varn 2.5 % Turbo sys.
- Compressible blanket 1.96 mm: Vulcan (lower H), Conti (higher H),
- Negative plates: Kodak thermal gold, Prinergy Evo CTP workflow

Production data:

- Productions data forms had been used in order to calculate productivity and break ratio
- MPS R3 program (ABB) statistics ⁽¹³⁾ as in figure.1

Figure 1.Details of one production run on statistic system of MPS[®] - R3

3 Results:

3.1 Paper Measurements

Table 3. a shows the average of measurements that were obtained for physical properties, table 3.b shows that tensile and elongation deviations as important factors of break ⁽⁹⁾ ⁽¹⁰⁾

	H	N	S	K
Basis weight	43.87	45.24	46.70	46.87
Thickness	66.76	65.78	71.43	72.5
W. Absorbency	66.72	66.65	75.80	69.12
Roughness	106.25	131.19	70.13	96.25
Moisture content	9.84	10.28	8.69	9.80
Elongation	0.82	0.93	0.92	0.85
Tensile	233.3	232	225.3	259.5

	H	N	S	K
Elongation dev.	0.41	0.966	1.16	1.52
Tensile dev.	11.43	9.91	12.48	17.74

Figure 2. Indicates the following:

- (N) Mill recorded higher values of: elongation, moisture content and roughness.

- (H) Mill recorded lower values of basis weight.
- (K) Mill recorded higher values of basis weight, thickness and tensile, whereas, higher values of tensile deviation and elongation deviation.
- (S) Mill recorded higher values of: smoothness, water absorbency, but lower values of moisture content.

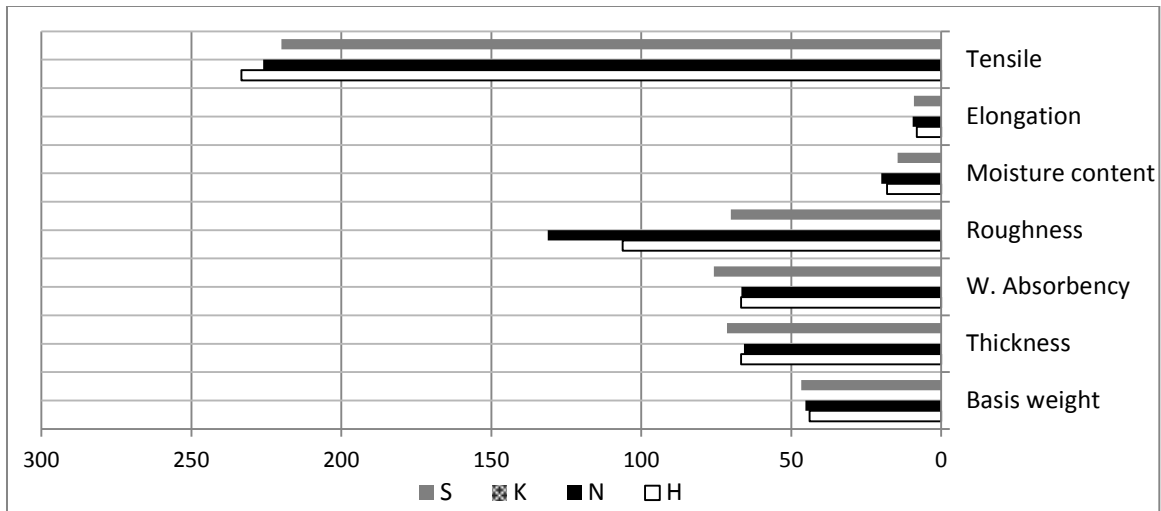


Figure 2) physical properties of paper mill

3.2 Run-ability Measurements

Production run data form, showed in Figure 3, express on singular test of (H) paper mill

Date 4 / 7 / 15	Batch no. Holmen 3185	Test code 1R
No. of web break 2	No. of pages 16	Total copies 72500
Waste caused of paper (%) 4.83	Waste caused of paper (copy) 3500	Total waste 7500
W_p weight 244.55 kg	Copy weight 69.87 gm	Basis weight (actually) 44.2 gm/m²

Figure 3) Run-ability data form of one production run

Copy weight = page area \times $\frac{1}{2}$ no. of pages \times actually basis weight = 69.87 gm

Weight of Waste caused of paper (W_p) = copy weight \times W_p = 244.55 kg

After the implied data forms had been collected and had been calculated the average of results as seen in table 4

Paper	Break ratio %	Paper waste%
H	1.5	3.2
N	1.3	2.4
S	2.8	4.1
K	2.0	3.6

According to table 5: mill (N) recorded the best results in the break ratio and paper waste, followed respectively by mill (H), mill (K) and the last one was mill (S).

3.3 Productivity Measurements

Production run data form, shown in Figure 4, express on singular test of (H) paper mill

Date 4/7/15	Batch no. Holmen 3185	Test code 2R
Waste copies 7500	Good copies 65000	Total copies 72500
Down time 50 min	Actual production time 130 min	Total production time 180 min
Average speed 50000 c/h	No. of web break 2	Waste caused of paper 3500
Productivity % 67.13	Actual productivity 33565 c/h	Expected productivity 50000 c/h

Figure 4) productivity data form of one production run

$$\text{Productivity} = \frac{\text{Total copies}}{\text{Expected copies}} \times 100 = \frac{72500}{50000 \times 2.16} \times 100 = 67.13\%$$

After the implied data forms had been collected and had been calculated average of results as seen in table 5

	Productivity %
H	76.6
N	80.4
S	66.7
K	69.8

Figure 5. Shows significance positive relation between Productivity and Break ratio

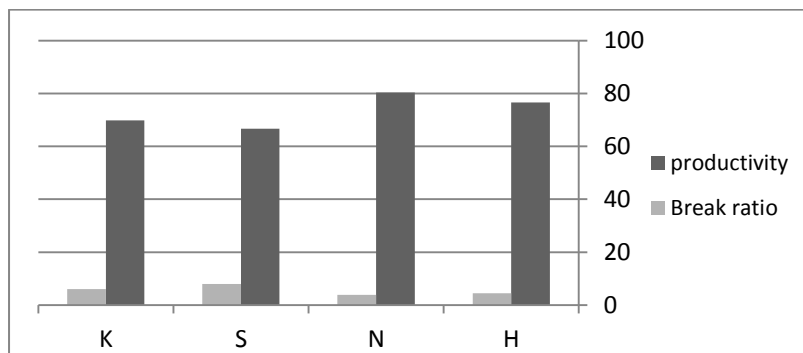


Figure 5) Productivity & Break ratio of paper mill

By using statistical analyses to examine the Pearson correlations between both of break ratio and productivity with the related physical properties, as shown in table 6.

	Tensile dev.	Elongation dev.	Basis weight	Thickness	Water absorbency	Moisture content	Roughness
Break ratio	.540	.54	0.59	0.86	.836	-.897	-.989
Productivity	.71	.98	-0.94	-0.97	-0.92	0.81	0.93

According to table 6:

The most effective properties on break ratio are: Water absorbency and thickness as a positive relation, and Roughness, moisture content as a negative relation.

The most effective properties on productivity are: Roughness, moisture content, Tensile deviations and elongation deviations as a positive relation, and thickness, Water absorbency and thickness as a negative relation.

3. 4 Impact of physical properties

The figures (6 : 12) show separately, the effect of each paper 's physical property on productivity and paper waste, that aimed to know which one has a major effect on quality

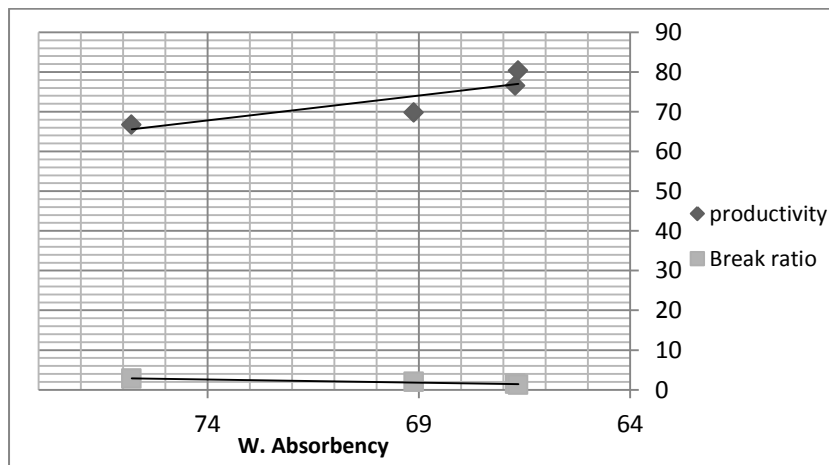


Figure 6. Effect of Water Absorbency

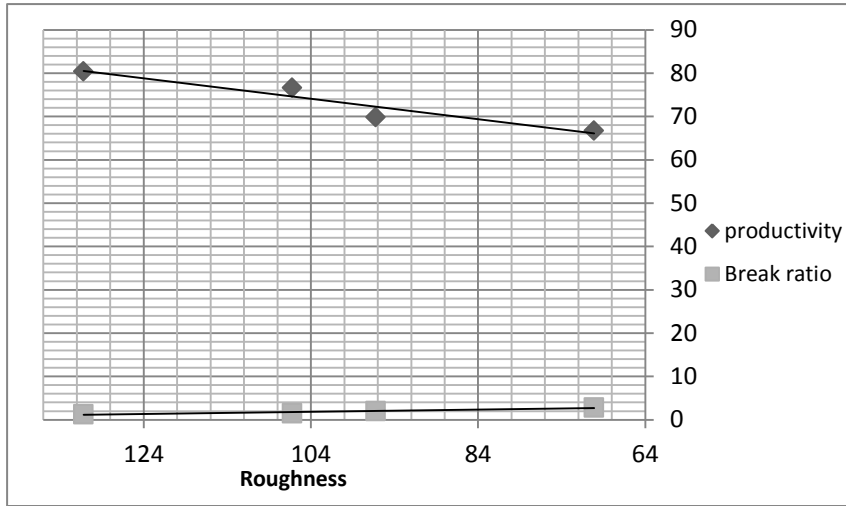


Figure 7. Effect of Roughness

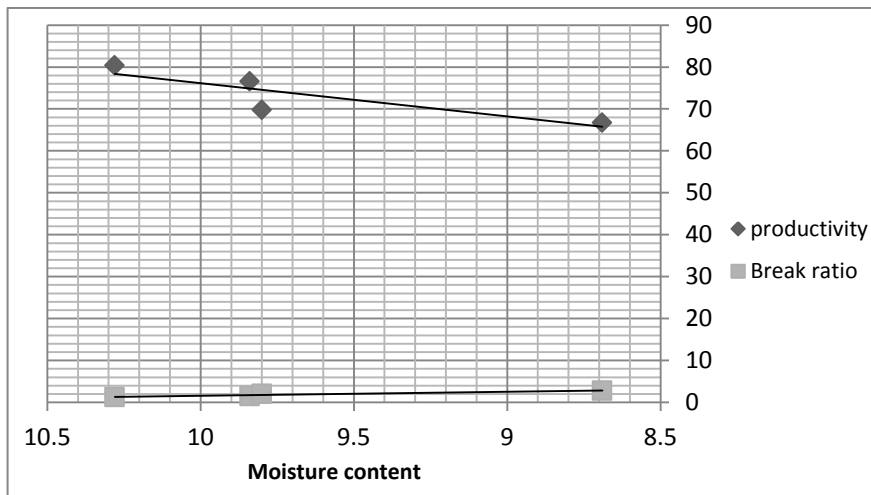


Figure 8. Effect of Moisture content

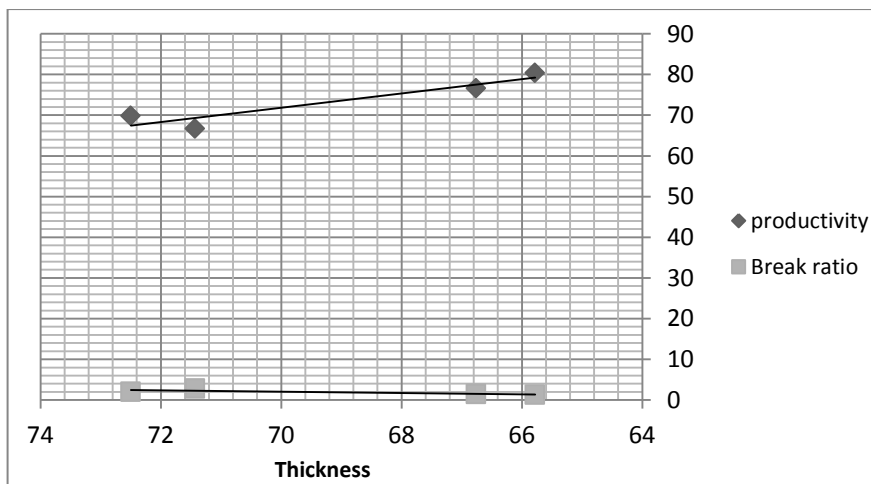


Figure 9. Effect of Thickness

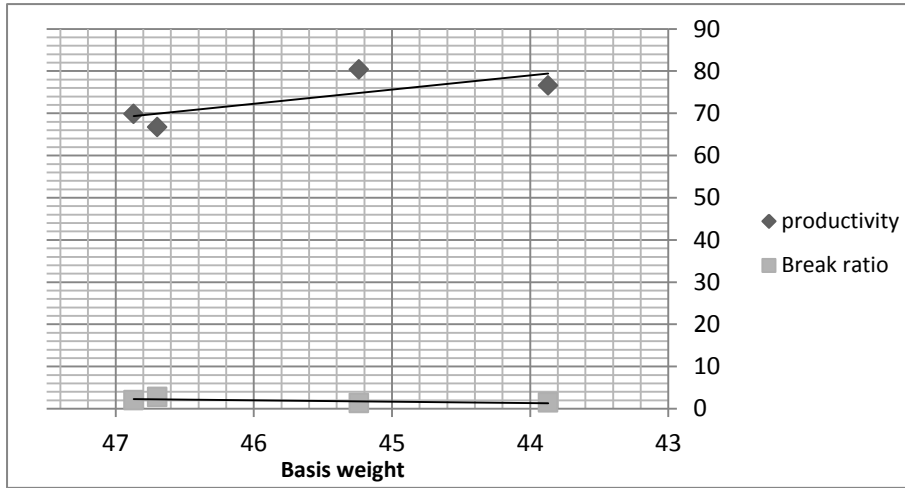


Figure 10. Effect of Basis weight

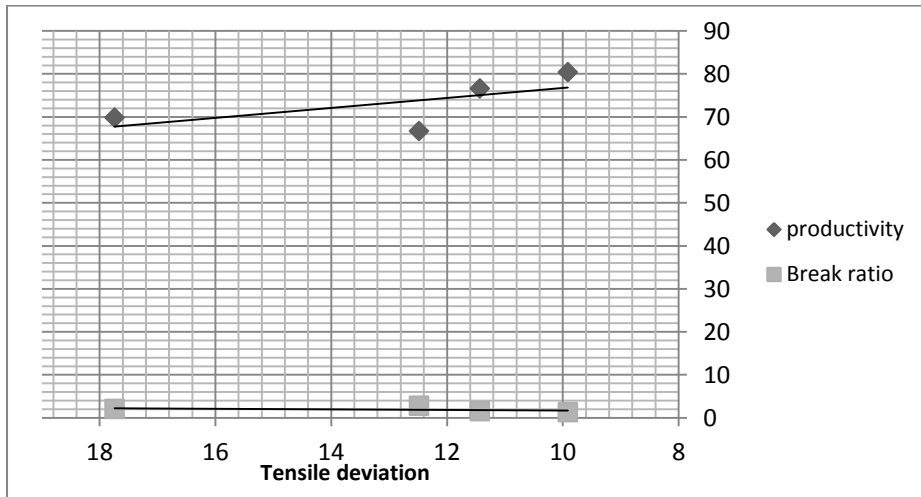


Figure 11. Effect of Tensile Dev.

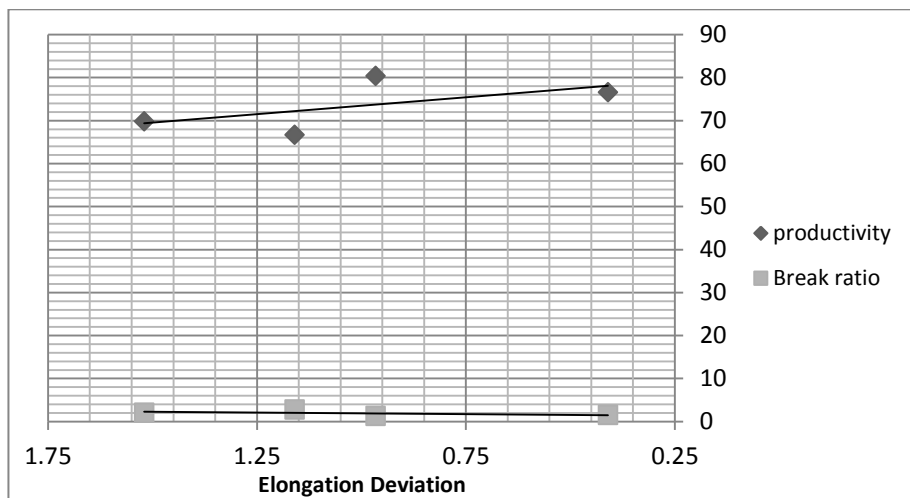


Figure 12. Effect of elongation dev.

4 Discussion:

Referring to the results:

(N) samples got the best run-ability, similarly recorded higher smoothness, moisture, elongation, lower bulk and water absorbency. On the other hand, (S) samples got minimal run-ability, similarly recorded lower smoothness, moisture and higher water absorbency. That means: decreasing smoothness, moisture content decreases run-ability.

Productivity has a significant association with roughness, elongation and tensile deviation, which means decreasing the roughness, tensile deviation increases productivity, while increasing of elongation decreases Productivity.

There is no statistical correlation between run-ability and (tensile, elongation) values, however, there is a clear correlation between run-ability and their deviations.

To get a high confidence results to calculate Productivity caused of paper, it should be considered as the following:

- Using an actual production time to calculate expected copies in an efficiency equation
- Neglecting of unplanned stops waste to calculate the total copies in an effectiveness equation

5 Conclusion:

It is noticeable, that Run-ability and Productivity one affect other.

The most influential physical properties of Run-ability are:

- Water absorbency, Thickness (positive correlation)
- Roughness, Moisture content (negative correlation)

The most influential physical properties of Productivity are:

- Roughness, Moisture content, Elongation dev. and Tensile dev. (positive correlation)
- Thickness, Basis weight and Water absorbency (negative correlation)

The results approved that the physical properties have major effect on run-ability and productivity.

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