How the Product Influences Productivity in Newspaper Printing – Summarising Key Figures from a Pre-study Phase of a Larger Project

Lena Halonen*, M.Sc. and Johan Stenberg, Ph.D.**

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Abstract: Productivity in print production is an elusive concept. Earlier studies have shown that the structure of a newspaper has an influence on stops and stop frequency and thereby on the total productivity. This paper reports some partial results from a project with the objective to find more exact ways of relating the structure of a printed product to the overall productivity. Its focus is on identification and analyses of stops in pressroom and mailroom in newspaper production.

The press stops have been categorised. Each category represents a specific area, for example the folder, or a specific event, such as a reel change. This is made in order to identify problem areas in the pressroom and mailroom. Statistics from newspaper printing plants underlie the categorisation and are used to predict the downtime and the number of stops that are likely to occur during a print run. It is also possible to analyse the influence of mailroom disturbances on down time in the pressroom. The correlation between different stop categories and the number of webs and inserts in the newspaper is tied out.

The study has been carried out at two companies that have provided detailed production data. The products studied are standard newspapers, in broadsheet as well as in tabloid format.

* Royal Institute of Technology, Stockholm, Sweden (lenah@kth.se).
** MWM Media Workflow Management AB, Stockholm, Sweden (johan.stenberg@mwm.se)

INTRODUCTION

Background

Today newspaper printing is a complex and time critical process. The product tends to become more flexible with respect to the number of pages, use of colour and occurrence of inserts (Liljekvist et al. 1998).

Different studies have been carried out in the field of productivity in newspaper-printing plants but productivity is still an elusive concept. There are no variables that measure pure productivity (Moilanen et al. 2000). Earlier studies (Stenberg 1997 and Liljekvist et al. 1998) have indicated that the product itself has an impact on the productivity as a whole. Also, the number of pages and the occurrence of online inserting operations in the mailroom will affect production speed. Stenberg's study was made at two printing plants, concerning two products with page counts normally between 44 – 76 broadsheet pages. In (Liljekvist et al. 1998) two similar companies and products with page counts between 24-60 broadsheet pages were analysed. These two earlier papers on the subject did not deal with the stop reasons.

A modern double width – double round newspaper press is designed to print 35 000 – 40 000 copies per hour in collect run. The actual output during production is far from these theoretical values according to earlier studies (Stenberg 1997 and Liljekvist et al. 1998).

This research project started 2001 to further investigate the relationship between the product printed and the productivity. The aim is to find bottlenecks and the main areas for development to increase runnabiltity in newspaper printing and mailroom operations. Initially, the project is focused on identification and categorising production statistics. Later in the project, more focus will be on productivity improvements – how can the overall productivity be improved in newspaper printing plants.

Limitations

In this study, the production process under observation is limited to the pressroom and mailroom. The study is based on production data from two printing plants and three different but rather similar newspaper products and their inserts.

Method

Two Swedish newspaper-printing plants have provided production data. The production data is collected from databases connected to the press control system. Some of the information was not possible to collect

in an appropriate format so paper copies have been printed out (from the database) and the information has been entered into spreadsheet software manually. At one of the companies the press operators manually report some of the errors into the system. There is no specific data from the mailroom available. The only information about the mailroom is when the press have to be stopped because of mailroom errors.

The data concerns production of two broadsheet products and one tabloid product. The page count varied from 36 to 76 (broadsheet) pages in product A, and 16 to 36 (tabloid but the number of pages has been converted into broadsheet) pages in product B, and 12 to 56 (broadsheet) pages in product C. Product A is printed in company G and product B and C are printed in company N.

All newspapers are printed on 45 g/m^2 newsprint. The studies cover year 2000 and the first quarter of 2001.

Some production runs have been excluded because it was obvious that the data included serious errors.

Literature study

The literature study involved previously published academic research results and articles in trade press in the field of newspaper production.

Field studies

One field study has been made at one of the printing plants during two nights and two days. One day has also been spent at the product-planning department (dummy work).

COMPANIES

Company G

The printing plant has four KBA Commander 70 (satellite) presses. The presses are double width - double round newspaper offset presses. Each press has one folder.

The presses are constructed to print at 35 000 copies/hour in collect run and at 70 000 copies/hour in straight run. Each printing press is connected to (exactly) one mailroom line.

Each line has an inserting drum with the capacity of inserting three products, one product from a Rotadisc and two products from hopper loaders. Maximum speed of each inserting drum is approximately 30-34 000 inserts/hour according to technicians and the mailroom manager.

Each mailroom line has two stacker pairs (four stackers) leading to one strapping machine. It is possible to get double straps or a "cross" strapping. The strapping machine works with 32-packages/minute single strap and 18-packages/minute double straps. At the end 11 loading docks (placed two and two above each other) are waiting for the completed newspaper bundles

The observations from company G are presented in figure 1, (data concerning one broadsheet newspaper). 1335 production runs (during 2000 and 2001), which stand for 4163 hours, efficient print time – excluding time for make ready, cleaning and downtime during production.

All presses/ pages	36	40	44	48	52	56	60	64	68	72	76	Sum
0 inserts		20	34	30	22	9	1		4			120
1 insert	18	27	94	90	66	40	29	45	12			421
2 inserts		22	40	104	79	81	40	59	37	32		494
3 inserts			13	28	29	54	46	64	24		10	268
4 inserts				7	4	11	7		3			32
Sum	18	69	181	259	200	195	123	168	80	32	10	1335

Figure 1. The total number of productions observed at company G and how they are divided between the different product structures. Page counts are in broadsheet format.

Company N

The printing plant has one double width - double round newspaper offset press with two folders.

The press is constructed to print 30 000 copies per hour at collect run and 60 000 copies at straight run. Two mailroom lines are attached to the press. Both folders can deliver newspapers to both mailroom lines.

One of the mailroom lines has only one pair of stackers. The other is a complete line, with trimming, one inserting drum (three hopper loaders). After the inserting drum there is one line with three stacker pairs (six stacker), and one line with ink jet addressing and quarter folding (two stackers). From these two lines the bundles go to two strapping machines or two machines that perform plastic wrapping of the bundles. Then the finished bundles go to the loading dock or to a pallet loading station.

For product B (one tabloid newspaper), 365 productions have been analysed.

B/Pages (In broadsheet)	16	18	20	26	28	30	32	34	36	Sum
	3	4	1	73	89	95	68	28	4	365

Figure 2. The total number of productions of product B observed at company N. The page counts are in broadsheet pages but the product is a tabloid paper.

For product C (one broadsheet newspaper), 294 productions have been analysed.

C/Pages	12	16	24	28	32	36	40	44	48	52	56	Sum
0 inserts	1	1	10	37	35	27	13	33	24	7	4	192
1 insert			2	19	21	22	8	12	13	2	3	102
Sum	1	1	12	56	56	49	21	45	37	9	7	294

Figure 3. The total number of productions of product C observed at company N and how they are divided between the different product structures. The page counts are in broadsheet format.

RESULTS

The parameters "average net production speed" and "average cruising speed" has been used. The average net production speed is the number of good copies printed divided by the total printing time, down time included. The average cruising speed is the total number of printed copies (waste + accepted copies) divided by the printing time, downtime excluded.

MTBM (Mean Time Between Maintenance) is defined in (Bergman et al. 1995) as "the average time between function breaking maintenance (helping or preventing)"

MDT (Mean Down Time) is defined as "the average length for the time period the system is not working, the time spent for waiting on staff is included" in (Bergman et al. 1995).

Company G

For the total production 1335 production runs during 5086 hours (all page counts and inserts included) the average net production speed is 19 913 copies/hour and the average cruising speed 24147 copies/hour. This means that even though the press prints 24 000 copies/hour only about 20 000 accepted copies per hour are delivered from the production plant.

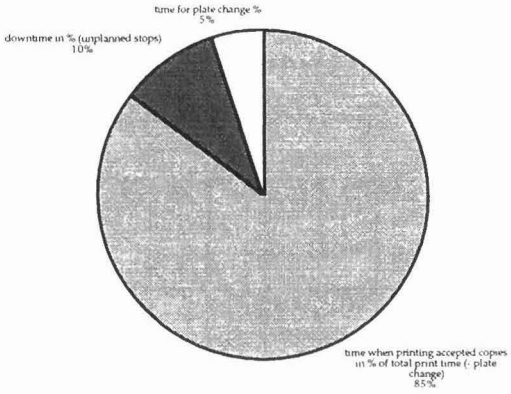

Figure 4. Shows how the time spent is divided between production and downtime.

Of the total time spent on producing newspapers, 85 % of the time is spent on printing good copies. The rest 15 % of the time the press is standing still. 10 % remaining are caused by unplanned stops.

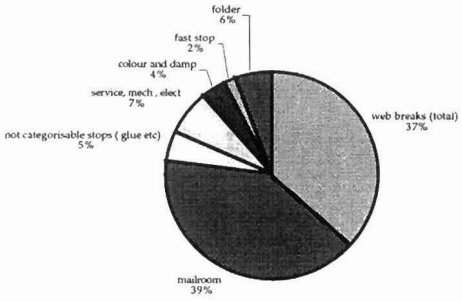

Figure 5. The downtime divided into categories.

In figure 5 the 10 % downtime is split into different stop categories. The web breaks and mailroom disturbances are dominating. Each stop occasion is defined as "during one day a stop of the specific category has occurred". This means that one or more stops can have occurred but it is reported as one stop occasion.

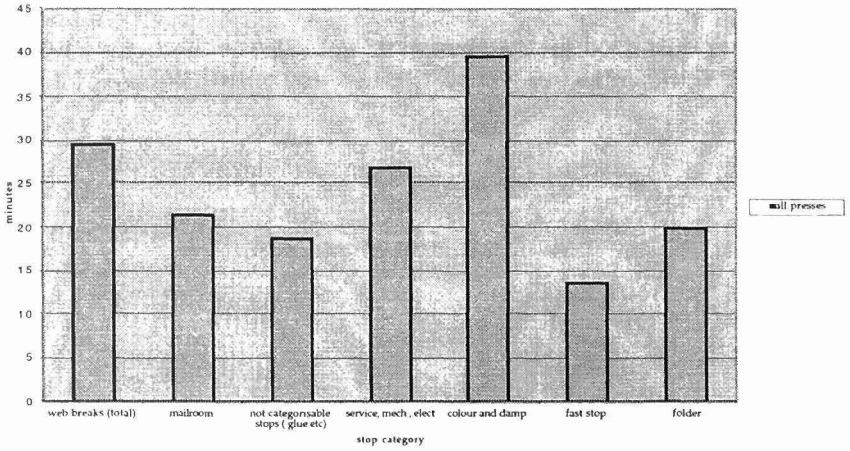

Figure 6. MDT for each stop category at company G.

The most common stop reasons, web breaks and mailroom errors, have an MDT of 29 minutes and 21 minutes respectively. The other stop categories take almost the same percentage of the total stop time. Colour and damping, service and mechanical errors have the longest MDT out of these.

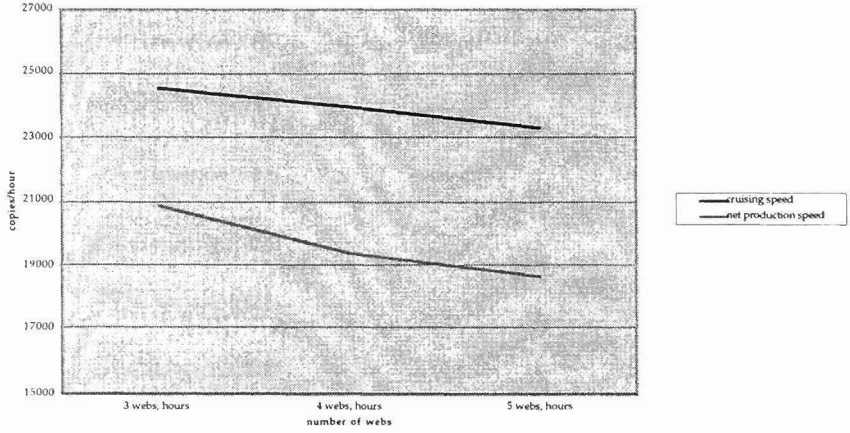

Figure 7. Shows the difference between average cruising speed and average net production speed. The classification into number of webs does not mean a classification of number of inserts. The figures for 3 webs contain 0-4 inserts etc.

For a three webproduction the average cruising speed is 24583 copies/hour, dropping down to 23982 copies/hour when using four webs and 23339 copies/hour for a five web-production.

The average net production speed decreases steeply from 20896 copies/hour to 19465 copies/hour when going from three webs to four. Then the speed drops somewhat down to 18715 copies/hour when introducing a fifth web.

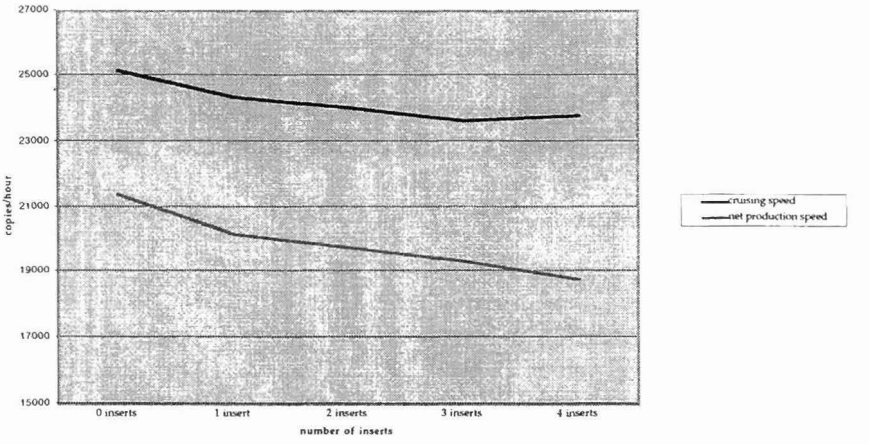

Figure 8. Shows the difference between average cruising speed and average net production speed. The classification by number of inserts does not mean a classification in number of webs. The figures for 0 inserts contain 3-4 webs etc.

The average cruising speed is 25168 copies/hour for a product with no inserts. When one insert is used, the curve drops steeply down to 24338 copies/hour. The decline is flattened out between one to three inserts and the speed decreases to 23660 copies/hour. With four inserts the curve raises slightly. This needs further analysis. Only 32 production runs with 4 inserts have been analysed, which makes the number of observations limited compared to the other configurations which include at least 100 observations.

The average net production speed is 21326 copies/hour for a product with no inserts and drops to 20175 copies/hour when inserting one product. Then the net production curve follows the same pattern as the curve for average cruising speed. But for a fourth insert the average net production speed decreases which indicates an increased number of unplanned stops when inserting a fourth product in parallel.

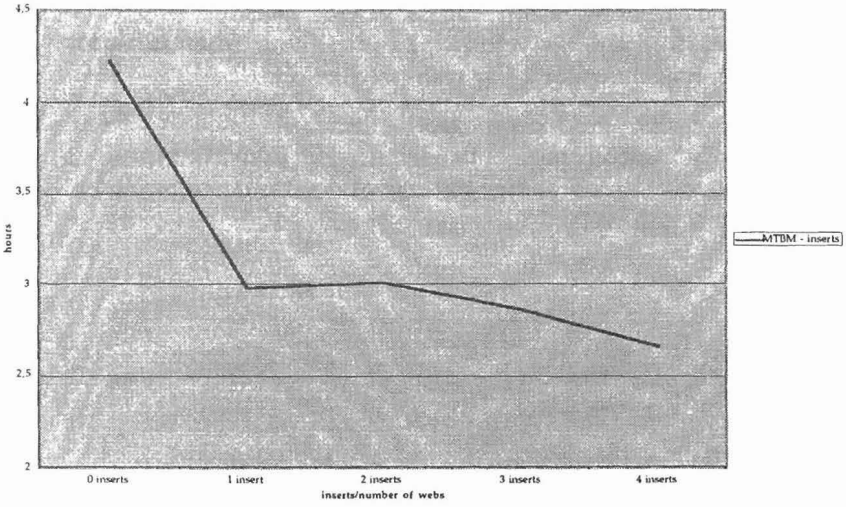

Figure 9. Shows the MTBM depending on the number of inserts

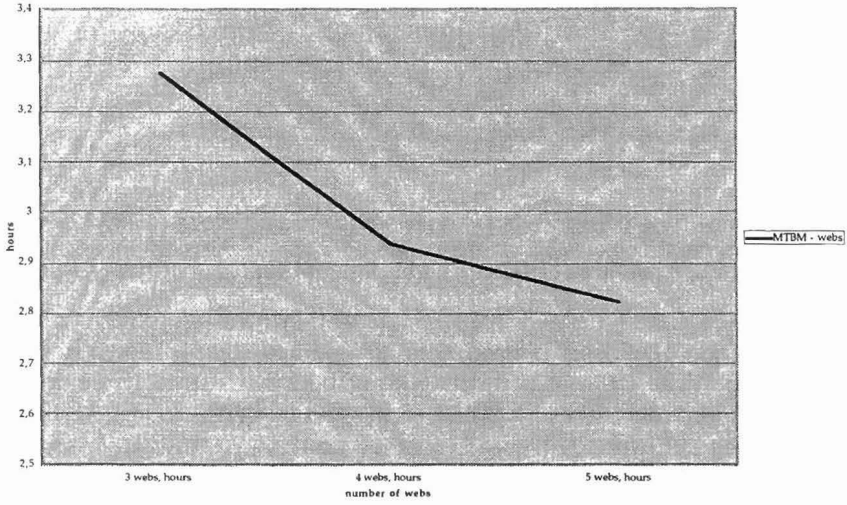

Figure 10. Shows the MTBM depending on the number of webs.

MTBM drops steeply when going from three to four webs and from no inserts to one. Also here the variations are clearer at lower web counts and number of inserts. Introducing a fourth insert will make the number of unplanned stops more frequent.

If we split case company G into four production lines and look at each one as a separate printing plant, we will find the same results as for the

entire plant. This indicates that in this case the results are valid for all the presses. In general, the result indicates exactly the same process behaviour in each of the four pressroom and mailroom lines.

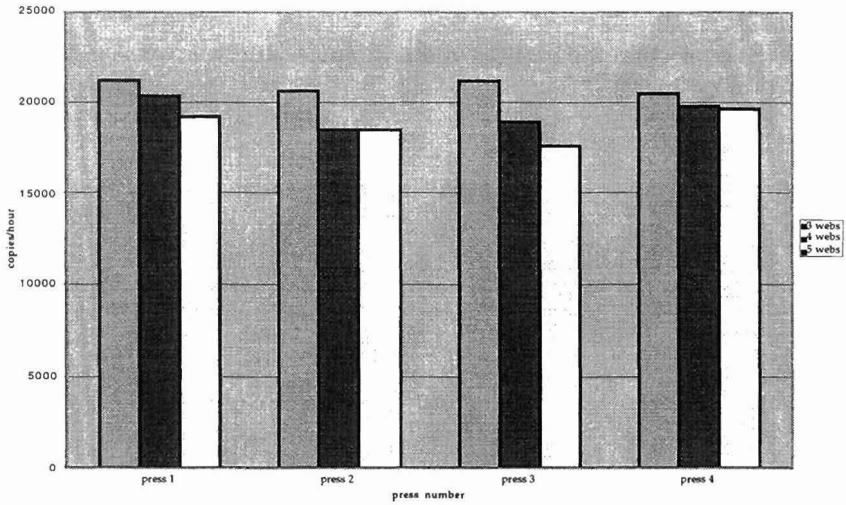

Figure 11. The average net productions speed in each one of the four presses. The productions runs are classified after number of webs.

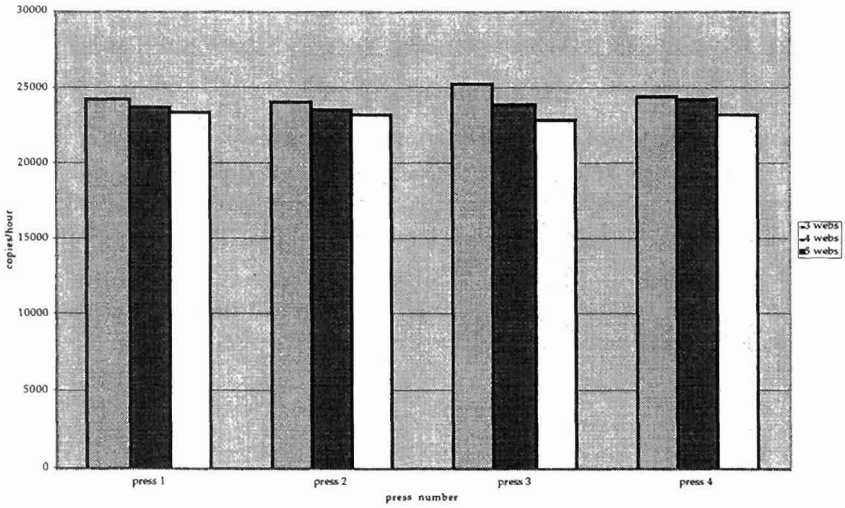

Figure 12. The average cruising speed in each one of the four presses. The productions runs are classified after number of webs.

Figure 7 indicates that the biggest decrease in average net production speed is when going from a 3 web-production to a 4 web-production.

The average cruising speed also seems to be more even than the average net production speed.

Figure 13 shows that the mailroom disturbances and the web breaks are (really) dominating.

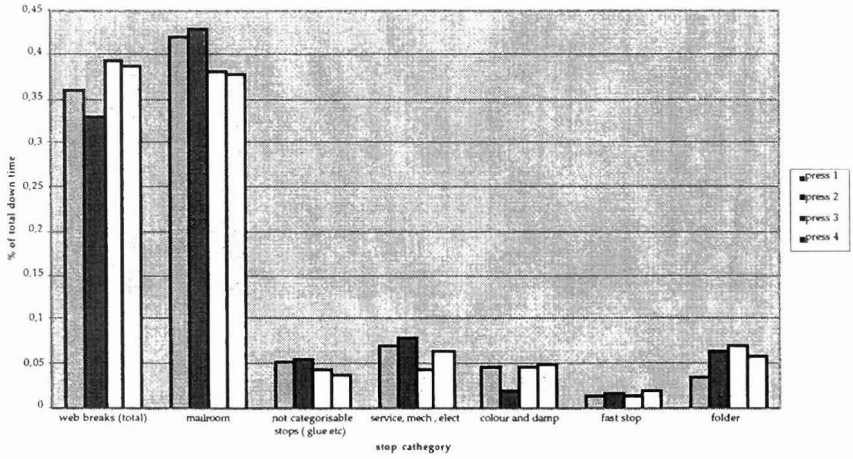

Figure 13. The % of total downtime each stop category holds for each press.

Case company N

For the tabloid product (straight run), the average net production speed is 40570 copies/hour and the average cruising speed 49544 copies/hour. The broadsheet newspaper has an average net production speed of 21243 copies/hour and an average cruising speed of 25501 copies/hour.

For the broadsheet product, 90 % of the production time is spent on printing good copies. 10 % of the time spent on production, the press is standing still due to unplanned stops or change of plates.

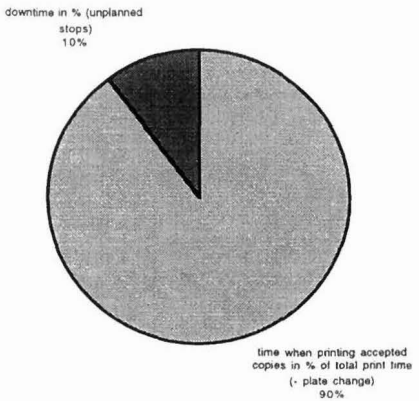

Figure 14. Shows how the time spent is divided between production and down time for product C (broadsheet). The unplanned stops include the plate changes. Since it has not been possible to separate them.

Four stop categories are dominating: non-categorisable stops, web breaks, gripper-conveyor/mailroom and plates.

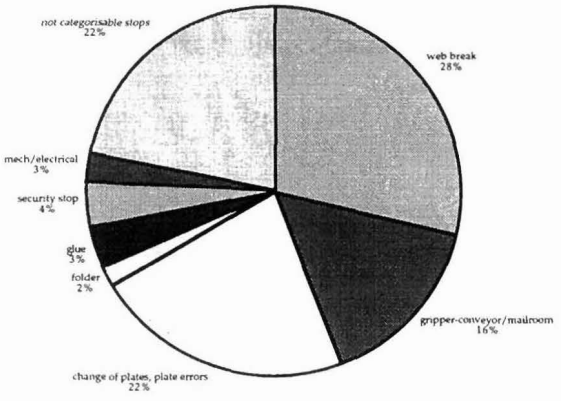

Figure 15. Downtime divided into different stop categories. The category for plate errors also includes the planned stops for change of plates.

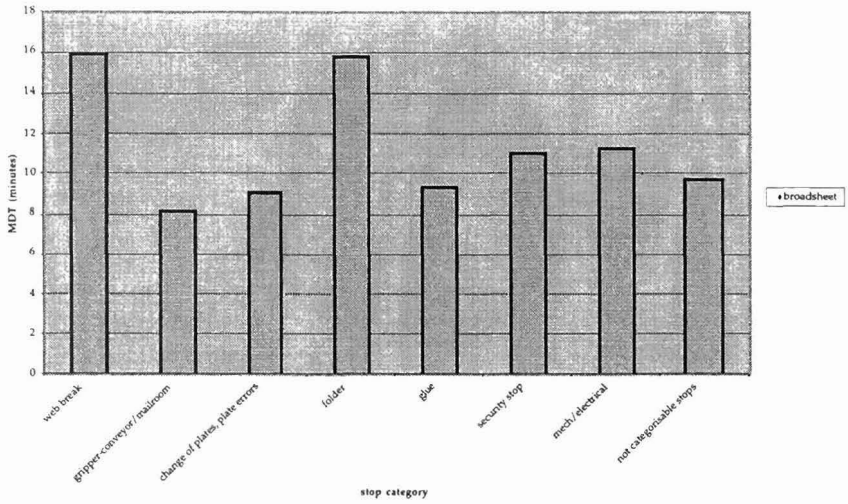

Figure 16. MDT for each stop category for a broadsheet product at company N.

Web breaks have the longest MDT and it is also one of the four most common reasons for the press down time. The average MDT is around 10-12 minutes.

For the tabloid product, 88 % of production time is spent on printing good copies. 12 % of the time spent on production the press is standing still due to unplanned stops or change of plates.

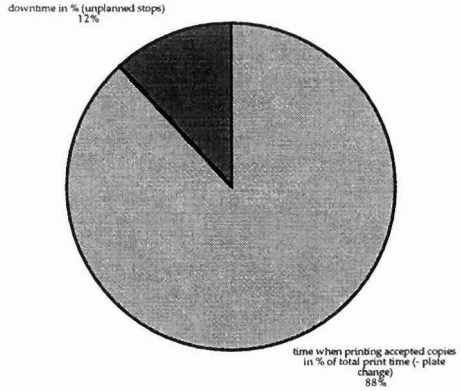

Figure 17. Shows how the time spent is divided between production and downtime for product B (tabloid). The unplanned stops include the plate changes.

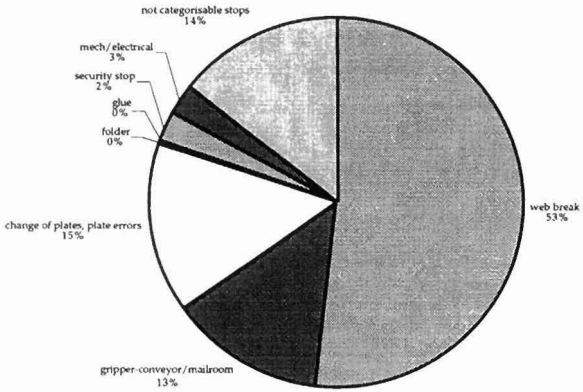

Figure 18. Downtime divided into different stop categories. The category for plate errors also includes the planned stops for change of plates.

For the tabloid product, the web breaks stand for half of the total downtime. The tabloid product has the same four main areas for downtime as the broadsheet product.

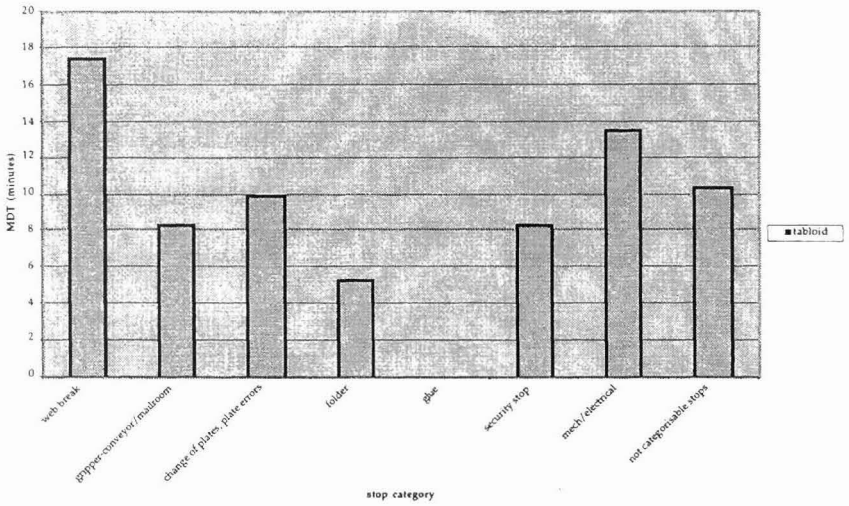

Figure 19. MDT for each stop category for a tabloid product at company N.

The mean downtime is almost the same for mailroom errors for a tabloid product without inserts as for a broadsheet product with 0 or 1 inserts. But mailroom errors occur slightly more often for the broadsheet product. The web breaks are as well as the MDT for a web break increasing for the tabloid product as well. The MDT for folder errors decreases a lot for the tabloid product compared to the broadsheet product.

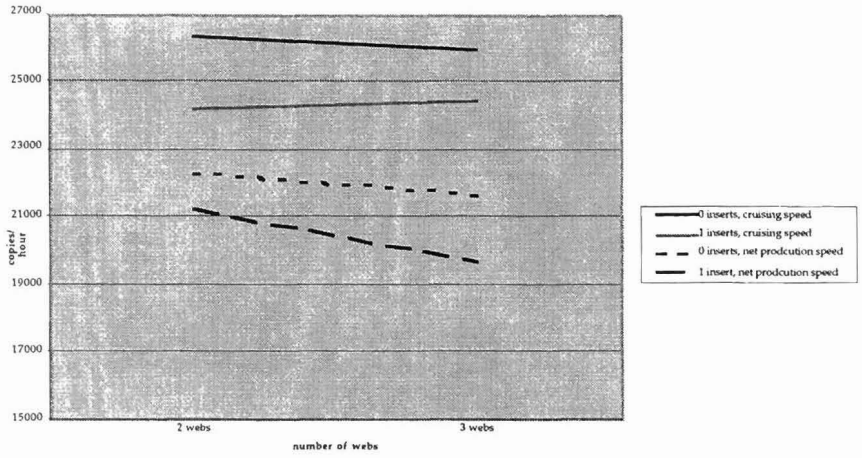

Figure 20. Comparison between two and three web productions, with no and one insert.

The average cruising speed drops slightly from 26313 copies/hour to 25973 copies/hour when going from two to three webproduction with no inserts. For the average net production speed, the figures are 22275 copies/hour going down to 21656 copies/hour.

For a product with one insert, the average cruising speed is 24185 copies/hour. In a three-web production, the average cruising speed increases to 24425 copies/hour. The average net production speed is 21212 copies/hour, dropping down to 19669 copies/hour for a three web-production with one insert.

This indicates that the number of inserts has a stronger influence on both average cruising speed and average net production speed than the number of webs. At least when dealing with a lower number of webs. The average cruising speed is very stable but the average net production speed decreases.

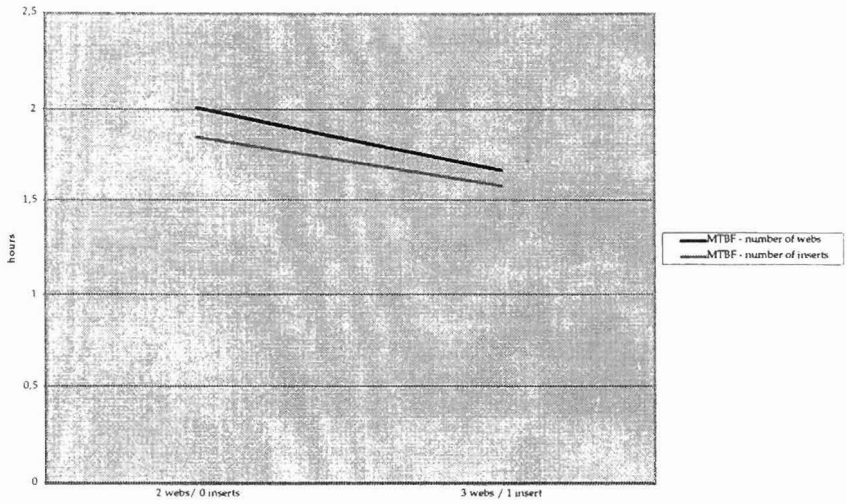

Figure 21. The MTBM for webs and inserts. The category axis X has two categories, both webs and inserts. This is for a broadsheet paper.

At company N, the MTBM curves are almost the same for both categorisations into webs as it is for categorisation into inserts. The MTBM drops, however, when introducing one insert and going from a 2-web production to a 3-web production.

DISCUSSION AND CONCLUSIONS

The main reasons for downtime are web breaks, mailroom disturbances and plate errors. In company G, the average web break is 29 minutes and a mailroom down time is 21 minutes for each production run with serious mailroom disturbances (causing press stops). For company N the same figures are 16 minutes (web breaks) and 8 minutes (mailroom stops) and plate errors have an average down time of 9 minutes. A probable reason for the longer down times at company G is that the products have more pages (more complex web leads) and more inserts.

Further mailroom investigations are needed due to the current lack of valid data. Research comparing printing plants that have a buffer between press and mailroom and plants that do not have buffers in between is also to be conducted. One area of future research will be an analysis of the frequency of web breaks in similar tabloid and broadsheet productions.

More statistics on tabloid production is needed to make thorough analyses. No conclusions can be made concerning the increase in web breaks when printing tabloid products. One probable reason is that the tabloid products lack inserts, which means a more straightforward mailroom operation.

Productions with two to three webs and no inserts have a stable average cruising speed. The speed is between 25 000 – 27 0000 copies per hour in this study. Earlier studies (Stenberg 1997 and Liljekvist et al.1998) also show that productions with lower web counts and no inserts are more reliable.

In general, productions with two or three webs have a stable average cruising speed.

For three to five web productions, the average net production curve is decreasing but the average cruising speed stays between 23 000– 25 000 copies per hour.

When the number of webs is increased from two to three, the average net production speed decreases and also when going from three to four webs. Introducing a fifth web does not influence the speed significantly.

One insert affects the average cruising speed and the average net production speed negatively and also the speeds are affected when introducing a fourth insert.

For company G the web – speed diagram includes products with no inserts to four inserts. To obtain better results, the data need to be

subdivided into three webs one to four inserts, four webs with no to four inserts and so on. More data is needed to make such an analysis.

MTBM is also affected more at lower web counts (two to three and three to four webs) and when introducing one or more inserts, especially when going from zero to one or from three to four inserts

Future research will include analyses of statistics from additional newspaper printing plants, including detailed mailroom statistics and also the use of regression analysis. The most challenging objective is to identify how the productivity in these kinds of printing plants can be increased.

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