Effects of newspaper structure on productivity

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Abstract

There has been a radical change in the newspaper production process in the last 20 years when the computers became a common tool. Printing presses also print more colours and pages at a higher speed. The mailroom process is becoming more automated and the production speed increases.

Not only technical changes have taken place. The circumstances for the graphic arts business have also changed. Today newspapers face competition from other media such as free sheets, The world wide web etc. both as news deliverers and as advertising channels.

On one hand the newspapers need to keep up the competition and the increased use of advertising inserts in newspapers is a result of this. On the other hand the increases use of inserts complicates the product and thereby the production process.

Earlier studies have shown that the structure of the newspaper has an impact on the productivity in the production process. Both the average net production speed and the average cruising speed decreases with the number of pages in the main product and the number of inserts.

The aim of this thesis is to:

- Identify the main reasons for unplanned stops and the occurrence of such stops in pressroom and mailroom.
- Analyse how different page counts in combination with the number of inserts in the newspapers produced influence productions speed, the occurrence of disturbances, and down time in both pressroom and mailroom.
- Discuss how different types of inserts affect production in the mailroom.
- Discuss how the disturbances and stops in the mailroom affect the mailroom personnel.

More knowledge of the influence the newspaper product has on the productivity can help to increase understand the process and manage and plan for the variations.

List of included papers

This study consists of three previously published research papers:

Paper 1: Halonen, L., Stenberg, J.: ”How the product influences productivity in newspaper printing — summarizing key figures from a pre-study phase of a larger project”, *TAGA 2002 Proceedings*, Rochester, 2002, pp. 1-20.

Paper 2: Halonen, L., Stenberg, J., Karlsson, A.: ”How newspaper product properties influence mailroom disturbances”, *TAGA 2003 Proceedings*, Rochester, 2003, pp 30-31.

Paper 3: Halonen, L., Andersson, S., Stenberg, J.: ”A study of mail-room runnability and the occurrence of unplanned stops”, *TAGA 2004 Proceedings*, Rochester, 2004..

The author has been the main contributor and author of all included papers. Johan Stenberg´s contribution to papers one and three has consisted in proof reading and discussing thoughts and ideas regarding the results and conclusions. In paper two both Johan Stenberg and Anders Karlsson had a similar role. The compilation of data for one of the studies included in paper three was made by Sara Andersson who has published her own analysis in her thesis for the degree of Master of Science (Andersson 2004).

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Introduction

Since computers became a common tool in newspaper production in the 1980's, the production process has changed radically. Communication networks make it possible to transfer large files over distances to prepress departments as well as between the prepress and the printing operations. Computers are used to control the incoming pages, computer-to-plate equipment is used for plate making. The printing presses are built to print more colours and more pages at a higher speed. Control systems make it possible to collect production data and production management systems can analyse production data and produce reports. The mailroom is also becoming automated and the production speed increases.

Many other changes also confront the graphic arts business. Today, newspapers face increased competition among themselves, with free sheets, and with other media such as television, the world wide web, and radio, both as news deliverers and as advertising channels. One consequence of this increased competition is a growing demand for zoning and an increase in the use of advertising inserts in the newspapers. Zoned inserts can give advertisers a better targeting of their campaigns and precision inserting thus gives additional competitive strength to the newspapers. At the same time, the use of inserting complicates the product and thereby also the production process.

Today, many newspaper publishers or newspaper groups no longer own their printing plants. Very few companies can afford to have a printing plant that only produces one newspaper and where the expensive equipment stands still for most of the time. The newspaper printing plants as well as the entire printing business have developed into a process industry with high demands on productivity and efficiency. Presses must be kept running and more and more commercial printing is produced also in the traditional newspaper printing plants.

The printing plants need to improve the production and the distribution of newspapers as well as other processes within the company (Rehn 2001).

Thus, newspaper printing plants are faced with the challenge of increasing productivity (here defined with the two measurements average cruising speed and average net speed, for further details see definitions) at the same time as the complexity of the products increases.

This study concerns the relationships between complexity of the structure of the products printed and the productivity in press and mailroom. The study focuses on newspaper production in Sweden.

The newspaper product

There are many different definitions of what constitutes a daily newspaper. Webster's 1913 dictionary defines a newspaper as "a sheet of paper printed and distributed, at stated intervals, for conveying intelligence of passing events, advocating opinions, etc." and the online WordNet dictionary proposes the definition "a daily or weekly publication on folded sheets; contains news and articles and advertisements". Organizations such as UNESCO, FIEJ (Fédération Internationale des Editeurs de Journaux), and ENPA (European Newspaper Publishers' Association) all have their definitions of different types of Newspapers. Common for all theses definitions is, however, that a daily is defined as a newspaper product published at least four days a week. The Swedish Newspaper Publishers' Association (Tidningsutgivarna) also describes a daily morning paper as a product published four to seven days a week.

In Sweden, there are two different categories of daily newspapers, morning newspapers and evening newspapers (Stenberg 1997). Two different physical formats are common, morning papers have traditionally been published in broadsheet format (40 x 56 cm) with glued pages, whereas evening papers have used the tabloid format (28 x 40 cm) with stitched pages. There is, however, a change of format underway. Since 1994, 27 morning newspapers out of the 141 newspapers (95 morning newspapers) that are members of the Swedish Newspaper Publishers' Association have converted sections of the newspaper or the entire newspaper into tabloid format (Stenberg and Wiberg 2004). Recently three large morning newspapers have decided to change the entire paper into tabloid format. The trend seems to be continuing.

In order to describe the structure of a newspaper product, I have used the IFRAtrack object model of a newspaper (Thoyer 1995). The terminology and the definitions are those used in the IFRAtrack model.

Figure 1 is an entity-relationship model of a newspaper. It shows the different parts constituting a newspaper product. An issue can consist of several editions. A new edition of an issue is created when there is a planned change of the content of at least one page in the newspaper. A newspaper issue is usually made up of different local editions. The different editions can be printed in the same printing plant or at different places.

The logical pages are built up of different elements such as text blocks, pictures, advertisements, etc. The logical pages do not have a page number, only when they are associated with a physical page there is a specific page number for each page. The pages are combined into sections. A product is a collection of printed pages or sections. It can be a whole newspaper, a section of a newspaper, or an insert. For the definitions of supplements, pre-prints and inserts see definitions).

The products may be printed in parallel, sequentially, or at different times and places. If the products are produced in the same printing plant, they are put together either in the printing press or in the mailroom. The product may also be finished in the distribution process. In this case the inserts are manually added to the main section (Stenberg 1997).

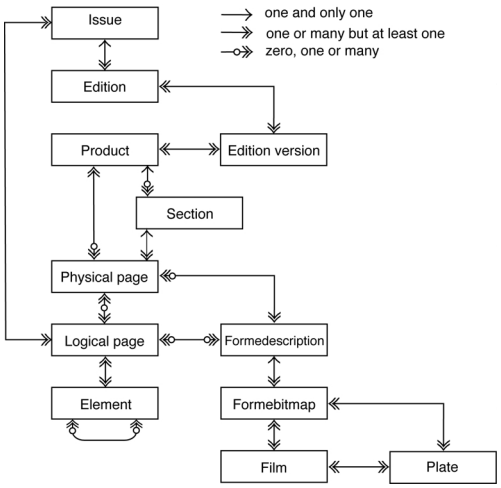


Figure 1. The IFRAtrack model of a newspaper (based on Thoyer 1995).

Figure 2 show an example of a hypothetical product here named Newsp. The figure shows how a newspaper is built up of different parts (two editions and three edition versions, City south, City north, and City (in the evening)), and it also illustrates the complexity of a newspaper as a product.

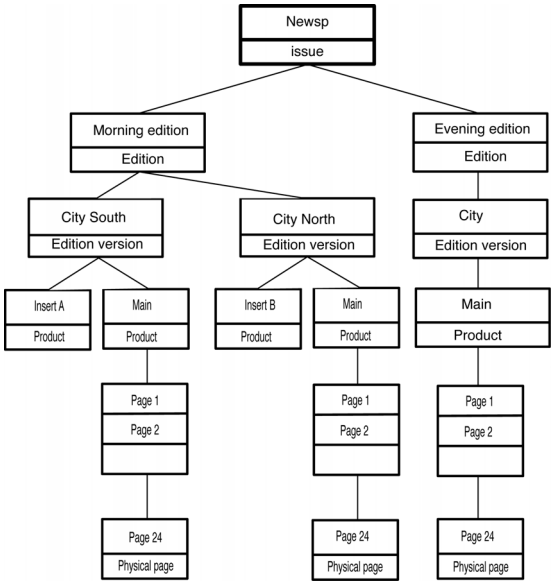


Figure 2. the product structure of a newspaper described as a hierarchical structure of objects (Thoyer 1995). The objects categories are the ones described in figure 1.

The printing press and the mailroom

The most commonly used printing presses for newspaper production in large Swedish printing plants are satellite offset printing presses. New and mid-sized plants often use 4-high offset printing presses. These are, however, more common in United States, Asia, and Australia (Kipphan 2001).

A general description of the equipment and flow in a typical newspaper mailroom is shown in figure 3. The numbers in parentheses in the following descriptive text refer to the numbers in the figure. The description only gives a general idea of a typical mailroom set-up. In practice, many variations exist. In larger plants, several parallel mailroom lines are used, and many operations are secured by doubling equipment and parts of the lines. Generally, it can be said that newspaper mailrooms are complex operations with complex machinery, complex material flow, and many tasks that will require frequent manual intervention in order to secure a smooth production flow.

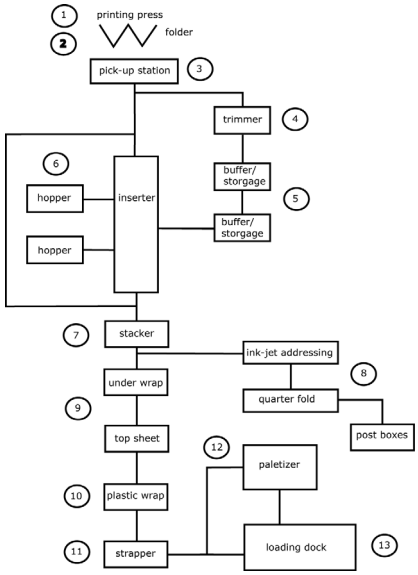
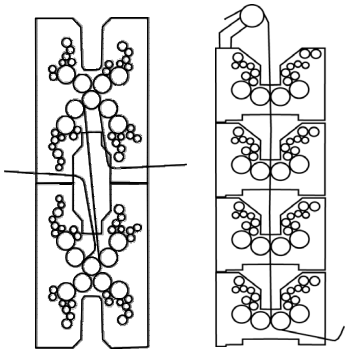
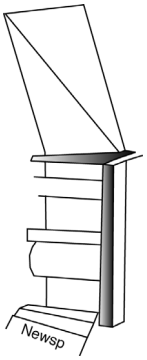


Figure 3. General scheme of newspaper mailroom production.



(1) The printing presses – the figures show both 4-high and satellite presses. Here the newspapers are printed. Four-high units can bee arranged in different ways. As the figure shows or the four units can be arranged in the inverted way or unit two and four can be arranged inverted to form two H-type units.

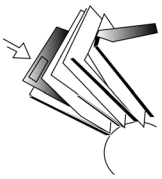


(2) The folder – here the printed paper is folded, cut and sometimes collected (see Definitions) to make up a newspaper copy. The newspapers are often glued or stitched before delivered to the mailroom.

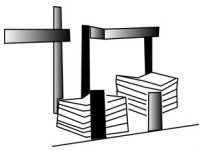
(3) The newspapers are picked up by gripper conveyors and delivered to the different machines in the mailroom. The mailroom is run either on-line or off-line with the pressroom.

(4) Trimming station – here the newspapers are trimmed, all three non-folded sides are cut, or only two sides. This can be made both off- or on-line.

(5) Storage/buffer – here the newspapers and inserts can be stored or buffered for later usage.



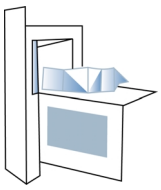
(6) The inserting process. – Here inserts are returned into the production line either from the storage/buffer station or from a hopper station or from both at the same time. The inserts are placed manually into the hopper stations. The figure shows a typical inserting drum (used by the companies in this study). The principle is that the newspaper is opened one or many times and the inserts are placed inside the open newspaper copy.



(7) The stacker makes bundles out of the single newspapers. The bundle size varies depending on the thickness of the single newspaper and on the requirements of the distribution.

(8) Separate lines are used for the newspapers that shall be delivered by post. The newspapers can be ink-jet addressed, quarter folded, and plastic wrapped. Then they are placed into boxes for delivery.

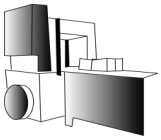
(9) Top sheet and under wrapping – a paper is placed under the bundles to protect them. A top sheet is placed on the bundles either manually or by machine. The top sheet contains information about delivery area, the number of newspapers to that delivery area etc.



(10) Plastic wrapping, the bundles are wrapped in plastic to protect them.

(11) The strapping machine – straps are put onto the plastic wrapped bundles to hold them together and it also makes it easier to move the bundles.

(12) The finished bundles can be placed on pallets before loaded on trucks.



(13) The finished bundles are delivered to the loading dock where the distributors are waiting. As said at the beginning of this section, postpress production is complex and each one of the machines presented here is a potential source of error in the production process.

Productivity

In most organisations it is possible to find different types of performance measurements. These measurements can be used for evaluations, planning etc. and to support the improvement of productivity in a company (Tangen 2003).
According to Neely et al. (1995):

- Performance measurement can be defined as the process of quantifying the efficiency and effectiveness of action.
- A performance measure can be defined as a metric used to quantify the efficiency and or effectiveness of an action.
- A performance measurement system can be defined as the set of metrics used to quantify both the efficiency and effectiveness of actions.

To make matters somewhat more complicated, there are many definitions of efficiency and effectiveness.

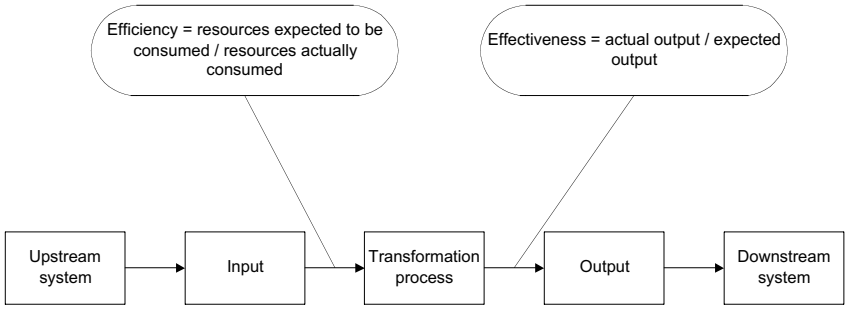


Figure 4. General definitions of efficiency and effectiveness (Tangen 2002).

As stated earlier, performance measures can help to improve the productivity in a company. Let us look at some different definitions of productivity, Misterek et al. (1991) write that "in their pure, theoretical form, productivity measures are measures of physical phenomena such as the transformation of energy to work and not measures of currency or other surrogates". Malmström et al. (1986) define productivity as "(in the industry) the productions efficiency, the relationship between resources and production results". According to Engström(1994), productivity can be expressed in physical terms such as produced units per work hour, in terms of currency, or as a number without any unit (a quotient between two indices).

Another often used definition is "for a system, productivity may be defined as simply the relationship between what goes into the system and what is produced, or more simply, the ratio of output to input" (Misterek et al. 1991).

This definition leaves options on choosing what should represent input and output. Tangen uses a similar definition (see figure 5).

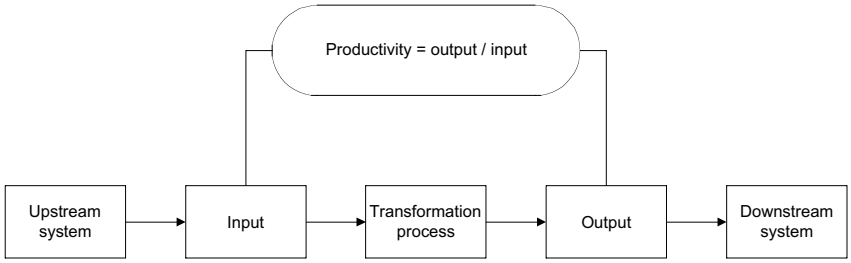


Figure 5. Productivity defined as a ratio of output to input of the manufacturing transformation process (Tangen 2002).

In this thesis, average cruising speed and average net speed have been used to measure productivity.

The field of research

To be able to use the equipment at a printing plant in an efficient way, efficient production planning is necessary. Such a planning includes the entire production including prepress, postpress and delivery operations. This research report focuses on product related parameters affecting the productivity in press and postpress operations in newspaper production. The research has been based on earlier studies on productivity in newspaper production. Stenberg (1997) and Liljeqvist (1999) have shown that there is a connection between how the product is configured and the productivity in the printing press and the mailroom.

More knowledge on how the product affects the production in terms of production speed, disturbances and unplanned stops could be of help in the planning phase.

The aim of the thesis

The aims of this thesis is to:

- Identify the main reasons for unplanned stops and chart the occurrence of such stops in pressroom and mailroom.
- Analyse how different page counts in combination with the number of inserts in the newspapers produced influence productions speed, the occurrence of disturbances, and downtime in both pressroom and mailroom.
- Discuss how different types of inserts affect production in the mailroom.
- Discuss how the disturbances and stops in the mailroom affect the mailroom personnel.

Delimitations

The study covers Swedish morning newspaper production. All newspapers studied are printed in broadsheet format, mainly on 45 g/m^2 newsprint, the page count varies, and the pages of the newspaper sections are glued. The number of inserts varies within the range of none to four. On-line production is used in the mailroom in all case studies.

The study does not cover financial, management. or organisational aspects of pressroom, mailroom or productivity, It is, however, necessary to have these factors in mind when analysing the results.

Related work

The research area of productivity has been covered in different fields and from different views and aspects in several reports and theses. However, these studies are mostly neither related to the newspaper business nor to the printing industry. As for the reports on productivity in the field of printing, most of them do not look at productivity in relationship to the product being produced. Here follows a summary of reports and theses related to the research field of this thesis.

Anon. (2001) presents key indicators for productivity evaluation. By using these indicators it is also possible to evaluate the degree of utilisation of specific printing processes and to compare different companies. The key indicators have been identified based on case studies and surveys. However, no key indicators were developed for the postpress operations since the companies in the study had very different postpress capabilities and equipment.

Common key indicators estimated to be relevant for profitability are (the explanations in parenthesis is only one example):

Times (delivery precision)
Quality (customer complaints)
Utilization of personnel (printed copies/persons, printed pages/person)
Utilization of machines (productive time)
Utilization of material (printed waste)

Also presented and stacker (10 %), waiting for plates (14 %) and web breaks (9 %) are among them.

Heil (2001) gives guidelines to the buyer of equipment on what to specify in the sales contract and what needs to be checked after installation. In the report, a formula for calculating the net performance of inserts is also presented. The formula takes into account basic net performance, main jacket in-feed speed, influence of main product, type of main product and inserts, page count in both main product and in the inserts, and the number of hopper feeders used. One example shows that the speed decreases with about 5000 copies per hour going from one preprint to one preprint and one insert.

Lindqvist et al. (2001) give guidelines for the make-ready procedure of a newspapers press. The report presents the impact that factors related to people, the environment, equipment, and materials have on the start-up, at editions changes, and at constant run. Waste analyses were conducted and downtimes noted with the purpose of optimising productivity in newspaper production.

The results are based on collected experience from newspapers, a brain storming session with the staffs, and a questionnaire.

Haeggström (1999) analyses the mailroom production at one large printing plant in Sweden. The production flow is described with focus on the disturbances in the mailroom. The analysis is intended to form a basis for decisions on further improvement projects in the mailroom.

According to Haeggström (1999), the inserting process (including winding, un-winding and inserting) is the major downtime reason in the mailroom, both with respect to time and to the number of stops. The trimming was found to be a large downtime reason despite the limited time of use. Two out of three mailroom lines had their highest percentage of downtime related to the winding process. The stops in the stackers and the strapping machines were many but no or very short downtime was reported. This was probably due to the fact that the press did not have to be stopped.

Lundbladh (1993) presents a formula for evaluating how difficult different impositions are compared to each other. One of the aims is to rank the impositions and thereby optimise the production in the press.

A formula is presented for calculating different ways of producing one specific product. The formula does not compare different types of products or how difficult they are to produce. According to Lundbladh (1993) web/ribbon-threading (tower-to-folder) has the greatest impact on how problematic a specific imposition is.

Carlerud (1995) deals with the importance of the concept of "total runnability", where both pressroom and mailroom are included.

The focus is on analysing the runnability in correlation to the number of pages in the printed product, the press configuration, and the handling in the mailroom. An analysis is also made on how the three factors (page count, press configuration, and the handling in the mailroom) affect the production speed, time schedules, and amount of waste.

Carlerud writes that one should look at runnability concerning the whole printing plant. Only then it is possible to form an understanding of how a certain product affects the runnability and to be able to plan the production according to that. Carlerud also states that the bundle size has an impact on the runnability and the mailroom in general has an impact on the production speed.

Bergström and Olofsson (2001) use an overall equipment efficiency (OEE) analysis on one printing plant. According to Bergström and Olofsson, the OEE figures are low at the studied printing plant compared to other businesses that lay around 26%. Therfore, comparisons should not be made with companies other than printing plants. The low figures are due to long preparation times and a poor degree of equipment usage. Bergström and Olofsson state that the mailroom affects the use of the machinery, meaning that the presses are far from being used at their capacity.

Another study (Anon. 1999) is based on surveys and database information on printing jobs. The report is intended to provide sheet fed printers with a way to benchmark their own productivity against that of others and of the leaders in the field.

The benchmarking has been made in four different areas:

- Job profile (what type of job the company handles, e.g., short run length, etc.)
- Running speed, make ready and drying time
- Waste and spoilage
- Downtime

Related topics such as pre-press productivity, web breaks, runnability, paper characteristic have been the focus in many related research reports during the past years. Web breaks and runnability have been covered by Parola et al. (2000), Parola and Linna (2000). Findings concerning paper characteristics and the relationship between paper characteristics and web breaks are described by Lindqvist et al. (2001) and Mäkelä (2000). Productivity studies and their relationship with the produced product have been covered by Stenberg and Liljeqvist (1997) and Stenberg (1997). Rehn (2001) discusses information flow and distribution planning in newspaper delivery.

Methods

Both quantitative and qualitative research methods have been used in this study.

To be able to find a model connecting product structure to productivity that will apply to different newspaper printing plants, comparable measurements are needed. At the beginning of the studies, I decided to use a quantitative approach based on production data. Later interviews were added to provide additional information.

The studies reported in this thesis were carried out during the years 2001-2004 at six newspaper-printing plants in Sweden. Three printing plants contributed with data and three additional companies were involved in interviews and company visits. The printing plants were selected in order to get a variation in both size of company and in the number of printed newspapers and the use of inserts. At the same time, there was a need to have similarities in order to be able to compare the results. One large company with four printing presses and two smaller companies with two presses were chosen. More information is given in the included papers.

The production data used was collected from databases containing data from the press control systems. For technical reasons, some of the information could not be obtained in an appropriate format, so paper copies were printed out from the database and the information was manually entered into spreadsheet software. At one of the companies, the press operators manually reported some of the errors into the system.

To cover the production and the mailroom in a broader manner, semi-structured interviews (Lantz 1993) were carried out. Seven interviews at different companies were conducted, five with mailroom managers and two with technical managers. Three of the interviews concerned computer systems and mailroom reports in general, and four were focused on mailroom layouts, stop reasons and inserts. Additional details on the interviews are provided in the included papers.

Observation was used as the primary method of collecting data on minor stops (see Definitions). The literature generally describes observation as a method for observing people, behaviour, etc., and seldom discusses observation as a method for collecting data, i.e., using qualitative methods to obtain quantitative data. Holme and Solvang (1997) speak of the two different methods of hidden and open observation. Bell (2000) uses the terms participant and non-participant observation. In this study, open non-participant observation was used.

In order to form a better understanding of the entire production process in newspaper printing plants, a number of study visits to the participating companies were made.

Summary of the included papers

This section presents a summary of the results presented in the three included papers. It also provides a description of the definitions used in the papers.

Definitions

The parameters "average net production speed" and "average cruising speed" have been used to measure productivity, although one can argue that these may not give totally accurate measurements of productivity (see Productivity). These measurements have the unit copies per hour. Collect run (succeeding layers of sheet bundles are superposed before the fold is executed) printing has been used (Kipphan 2001).

The average net production speed is defined as the number of good copies printed divided by the total printing time, downtime included but plate changes excluded.

The average cruising speed is defined as the total number of printed copies (waste + accepted copies) divided by the printing time, downtime and plate changes excluded.

MTBF (Mean Time Between Failure) is the mean time between failures of the operation calculated through operating hours / number of failures (Slack et al. 2001).

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

Inserts are here defined as all types of pre-printed products inserted in the main newspaper. It is the inserting process and the format, page count and paper quality of the inserts that are important, not the information content.

Minor stops are defined as the short stops or disturbances in the mailroom that do not interrupt the production flow, i. e., they do not cause stops in the production.

Paper 1

This paper deals with identifying stop reason for the press and with the relationships between the structure of the printed product (a combination of the number of webs used and the number of inserts) and the measurements average net speed, average cruising speed, MTBF, and MDT. In addition, a question on what the major stop reason for the press are was made to 10 printers at one of the companies (theses results were not included in the published paper).

The results of the study are summarized in table 1 and figures 6 through 8. These figures are somewhat modified from the figures in the included paper. Additional information on the relationship between the two speed measurements and the number of pages and number of inserts has been included here. The new figures are based on the same data as the figures in paper one but here only product categories containing 20 or more product runs are included (table 1). Actually, more than 20 similar products in each category would be preferable in order to have a better basis for conclusions. But since there was a need of variation in product category, those categories with at least 20 or more were chosen.

The study is based on production data from two companies and two broadsheet newspaper titles. The data covers a year of production from both companies. Table 1 shows the variation in product at company G (the coding of the companies is given in paper 1).

Table 1. Product variety at company G. All the production runs are shown in the table.

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

The production time schedules are the same from one day to another except for Saturdays and Sundays when 30 minutes are added to the estimated production time. This means that a newspaper with no inserts and 40 pages can have the same estimated production time as a newspaper with, for example, 72 pages and two inserts.

Of the total time spent on producing newspapers, 85 - 90 % of the time is spent on producing newspaper copies. During the remaining 10 - 15 % of the time the press is standing still. The start-up time is not included in the study. The main reasons for press downtime are web breaks, mailroom disturbances, plate errors, and non-categorised stops. The printers claim maintenance to be one of the main reasons for downtime in the press.

In company G, the average web break lasts 29 minutes and a mailroom stop lasts 21 minutes. For company N, the same figures are 16 minutes (web break) and 8 minutes (mailroom stop).

Looking at the average production speeds of the two printing plants (average over all productions), the difference between average net production speed and the average cruising speed is about 4000 copies per hour.

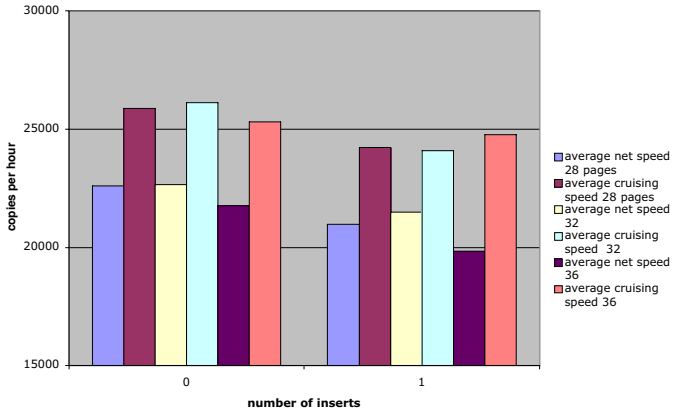


Figure 6. The average net production speed and the average cruising speed at company N.

One insert affects the average cruising speed and the average net production speed more than when introducing two or more inserts. The average cruising speed has about the same value for one to four inserts but the net production speed curve is decreasing (figure 7).

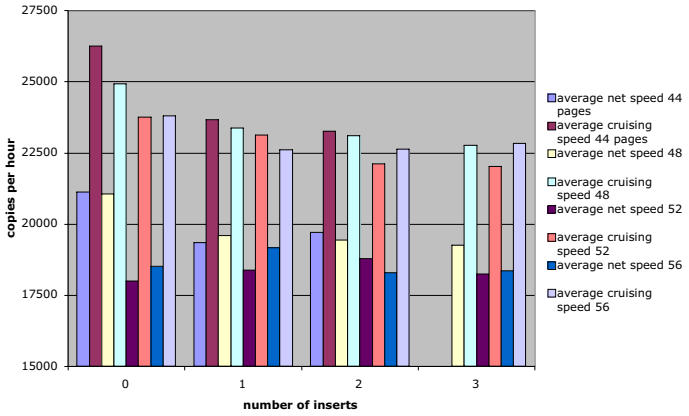


Figure 7. The average net production speed and the average cruising speed in relation to the number of inserts at company G

MTBF is 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 insert or from three to four inserts (figure 7)

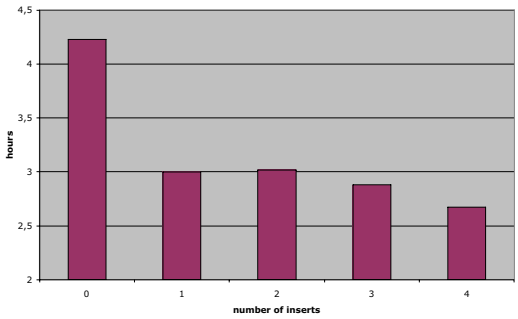


Figure 8. The MTBF in relation with the number of inserts. The value for one insert includes all different page counts in the main newspaper at company G.

Paper 2

This paper concentrates on the productivity in the mailroom. The mailroom is dealt with as one operation and not on a specific machine level such as inserter, stacker, etc.

The main results are presented below using figures that have been modified from those presented in the paper. The MTBF is here shown in increasing order instead of product category order for the three companies studied.

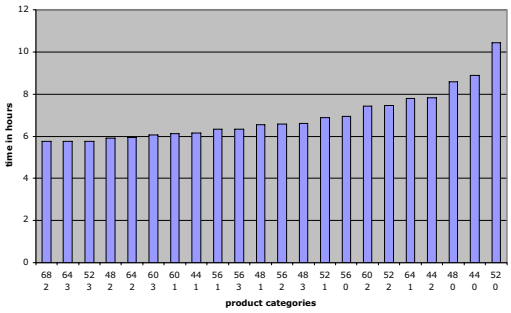


Figure 9. MTBF in the mailroom for different product categories in company one. The code 44 0 indicates a product with 44 pages and no inserts.

Figure 9 shows the distribution of MTBF for different product structures. We can roughly divide the data in figure 9 into three categories: up to six hours, between six and eight hours and over eight hours. In the category up to six hours, the average number of pages is 59 and the number of inserts is 2.5. The products in the category between six and eight vary a lot in both number of pages and number of inserts. The average values are 54 pages and 1.5 inserts. And in the last category, with a MTBF of over eight hours, we see only products with no inserts and few pages, the average values are 48 pages and no inserts. There is a tendency that the MTBF is shorter for products with inserts and longer for products without inserts.

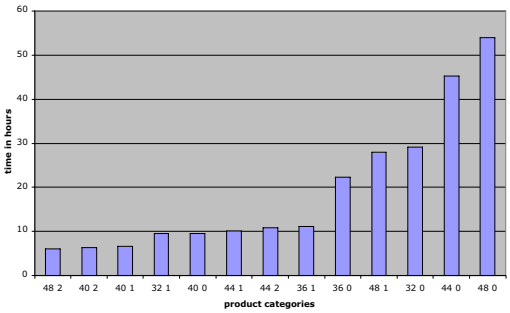


Figure 10. MTBF in the mailroom for different product categories in company two.

Figure 10 indicates a more or less obvious categorisation: products with MTBF under 10 hours, around 10 hours, between 20 and 30 hours, and over 30 hours. Here a clear pattern can bee seen. The MTBF is longer for products without inserts.

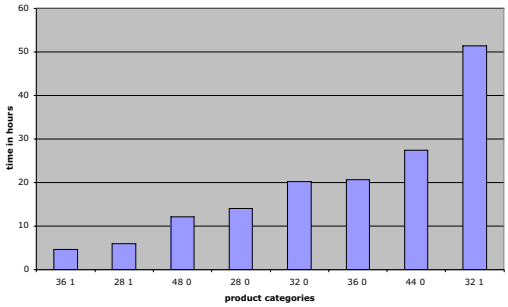


Figure 11. MTBF in the mailroom for different product categories in company 3.

In the same manner we can divide the data in figure 11 into categories with MTBF up to ten hours, between 10 to 20 hours, and over 20 hours. The products with MTBF under 10 hours are the ones with inserts. The largest difference is between no inserts and inserts.

When looking at the MDT, the interval is the same for products with and without inserts. The shortest downtime is about the same for all types of products, but the longest downtime is larger for products with one to three inserts than it is for products with no inserts.

The study shows that a certain type of products, produced with a low disturbance percentage at one company, may very well be produced with disturbances at another company. This makes it difficult to come to any specific conclusions on how the number of pages and the number of inserts affect manufacturing disturbances.

It is, however, clear that the inserts do affect downtime in the mailroom. For company 2 and 3 the downtime percentages are doubled when going from no inserts to inserting. At company 1 there is also an increase but it is not as clear as at the other two companies.

Paper 3

This paper deals with the minor stops and disturbances that occur in the mailroom. These are stops that the staff handles during production and that are normally never reported. The study was made in order to see how the product, and mainly the number of inserts, might influence the speed, downtime, or number of stops in the mailroom. We also wanted to investigate if the mailroom stops that affect the press are related to any specific machine in the mailroom. In this study on minor stops, the ink jet addressing and quarter folding line (see figure 3) was not included. An overview of the data sources for the study is given in table 2.

Table 2. Overview of press and mailroom data sources. PCS = press control system.

COMPANY	PCS	PCS REPORTS INCLUDING MAILROOM	MAILROOM DATA SPECIFIED	DOWN TIME REPORTED	MAINTENANCE REPORTS
A	X	X	X	X	COMPUTER BASED
B	X	X	X	X	COMPUTER BASED
C	X	X	X BY PERSONNEL	-	PAPER
D	X	X	-	-	PAPER
E	X	X	-	-	PAPER
F	X	OFF-LINE PRODUCTION	-	-	PAPER

The average downtime for a minor stop is about 50 seconds. This sounds very small but if the stop becomes one minute long, the personnel has to start moving the bundles from one line to the other manually.

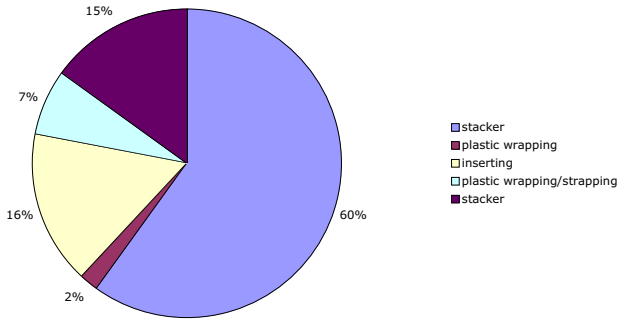


Figure 12. The minor stops divided into stop categories

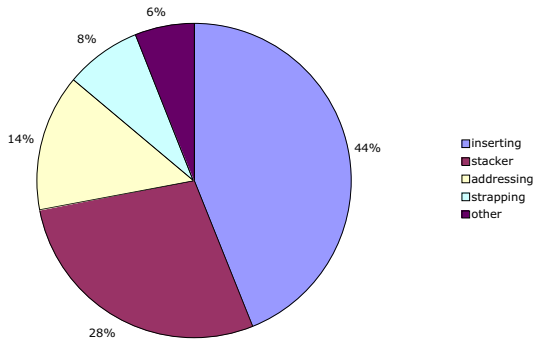


Figure 13. The mailroom stops that affect the press divided into stop categories.

Figures 12 and 13 show that the minor stops are caused by different machines than the mailroom stops that affect the press. The data is, however, gathered from two different companies. 90 % of the minor stops are caused by the plastic wrapping machine and the strapping machine whereas the mailroom stops that affect the press are mainly caused by the stacker and by the inserting process. Inserts coming from external costumers are seen as a major cause of problems at the companies where interviews were conducted.

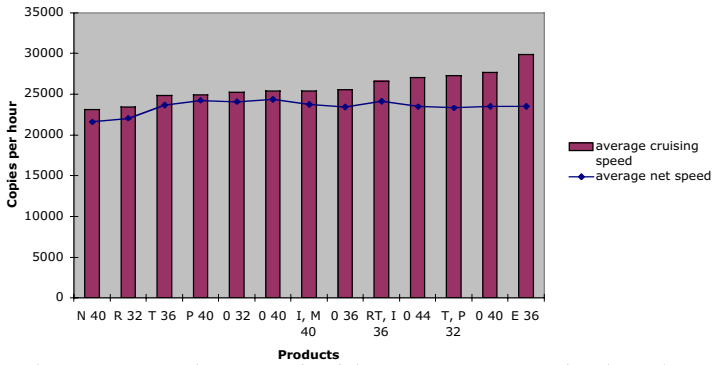


Figure 14. The average net production speed and the average cruising speed in the mailroom

In this study, the highest average net production speed in the mailroom was around 25 000 copies per hour. The average cruising speed is about the same but when the average cruising speed increases, the average net production speed does not (figure 14).

The number of stops seems to be larger for products with no inserts and for products with two inserts. The most likely reason for this is that with no inserts, the press speed is kept higher which may cause problems whereas with

two inserts, problems with the format and condition of the inserts might affect the number of stops in a negative way. Another observation made was that there occurred more minor stops at the beginning of the night. The second mailroom line (the studied company had two mailroom lines, one of them was used for production of a second newspaper and switched to produce the studied newspaper later in he evening) also had more problems at the beginning of the production run. In this case, another product had been produced earlier and the line was adjusted to fit the observed product only after half of the total production time. The reason that more stops occur at the beginning of a production run is most likely that the machines need to be adjusted to fit the particular product and bundle size.

Discussion and conclusions

Specific conclusions

A correlation between the product structure and the press and mailroom productivity in newspaper production can bee seen already in earlier research. The three included papers confirm this.

The press is normally standing still for about 10% of the total production time. This would mean 24 minutes if the total production time were four hours. At all the three studied companies, web breaks, mailroom disturbances, plate errors and non-categorised stops were the main reasons for press downtime.

At two of the printing plants, the difference between the average net speed and the average productions speed was about 4000 copies per hour.

The average cruising speed decrease with the number of pages and the number of inserts. The inserts have a greater impact on the speed reduction than the number of pages in the main product (figure 6 and figure 7). The average net speed does not seem to vary as much as the cruising speed. This indicates that it is not profitable to run the press faster because it will not result in more good copies printed per hour. The study on minor stops also confirms this (paper 3).

Products with more pages and inserts have lower MTBF. The producttion runs with an MTBF up to six hour have an average number of 59 pages and 2.5 inserts, and productions with an MTBF over eight hours have 48 pages on average and no inserts. Studies from two additional companies show the same results; more complicated products have shorter MTBF and less complicated have longer.

The study on minor stops in the mailroom (paper 3) shows that the average net speed and the average cruising speed in the mailroom were equal at 25000 at the company observed. But when the average cruising speed increases, the average net speed does not. More minor stops were noticed at the beginning of a production. When the minor stops reach certain duration, it is no longer possible for one person to handle the situation. Additional staff is needed to move bundles and to remove the cause of the stop. The stacker produces bundles at a certain fixed speed and when the belts leading to the plastic wrapper are full of bundles, these must be removed manually. At the studied company, the critical stop time was around one minute and the average duration of a minor stop was 50 seconds, in other words very close to the limit. Even if the minor stops do not stop the press or cause any visible reduction in mailroom productivity, they are still costly for the company since they require the presence of additional staff to manually handle the disturbances.

General conclusions

One general conclusion that can be made is that the product structure does influence the productivity. Inserts also have a greater impact on productivity

than the number of pages. Based on the available data, it is difficult to draw more specific conclusions regarding the effects of product structure on productivity or to perform any deeper categorisation into product groups (combinations of pages in the main product and number of inserts). The studies also show that one type of product that works well in one plant might as well not work as well in another plant.

The average net production speed and the average cruising speed decrease with the addition of inserts. Both speed measurements also show a decrease with an increased number of pages in the main product. The studies included in this thesis as well as earlier studies by Stenberg (1997) and Liljeqvist (1999), show the same type of results.

Disturbances in the mailroom are a major cause for press down time. This has also been shown by three other studies (Liljeqvist 1999), (Anon. 2001) and (Andersson 2004).

Increasing press speed over a certain optimum will not increase the net production speed, i.e., the total number of newspapers delivered from the printing plant will not increase. The length of the belt connecting stacker to plastic wrapping and strapping machines can be of importance when it comes to minor stops. Also maintenance of the machines is important and often probably overlooked.

Discussion

There are many variables to take into account when analysing productivity data. We have only been looking at the variations in page counts and number of inserts. Maintenance is a very important factor that has not been studied. Are the machines regularly maintained and at what frequency? The training of the personnel to handle different machines is another. Are there any economical benefits in reducing minor stops and other stops? Would it be more productive to use variable time schedules in press and mailroom production?

How important is time? The mailroom stops at some companies are not registered and even if they are the down time is rarely noted. This leads to the question about what data is relevant to collect and what analyses should be made.

The French newspaper company Ouest-France does not use additional mailroom lines or buffer systems but keep the machines maintained frequently. They also collect production data for analyses (Gallion 2001). This has resulted in very few disturbances and stops during the production.

Newspaper printing plants in USA and in other countries are facing the same problems as the Swedish ones. More and more inserts (in the USA the number of inserts can be around 40 while in Sweden it is only two or three), mean problems for the in many companies old mailrooms in keeping up with the press (Moozakis 2004). Often off-line mailroom production is used to alleviate the problems.

The newspaper Chicago Tribune has published a specification for inserts for their customers. They have noticed a positive effect on the production situation after the introduction of this specification (McMeekin 2004).

Further research

Finding a model for estimating production time for certain products will be difficult. It is not possible in practice to do experimental productivity research at a printing plant, running different productions with variations in the production speed. It is therefore necessary to rely only on collected production data and observations.

This means that much more similar data from additional printing plants is needed in order to be able to draw more general conclusion.

Interviews with staff on how inserts and the main product affect productivity and on how different machines work are needed to complement the data. Interviews regarding collected data and what analyses are made are needed for a more global view of the production situation. At what frequency maintenance is made and what sort of maintenance it is, needs to be investigated.

So far, my research has been focused on broadsheet newspapers. Data was, however, collected in paper 1 on one tabloid product. The analyses show that mailroom stops form an even a greater part of the total downtime for tabloid products than for broadsheet products. Since many of the broadsheet papers are currently converting into tabloid or into a combination of a broadsheet product and a tabloid product, it would be interesting to perform studies on tabloid products as well.

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These years working on this thesis have had its ups and downs, just like any other work. Ups when doing the actual research and writing papers, downs when stuck writing the papers. In those moments (yes, they happened more than ones) I have felt really in need of my friends who all been of great support and always are fun being around. They light up my days of downs.

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