1995 TAPPI/FBA corrugated productivity survey

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This survey can serve as a useful benchmark to answer many questions and point the way to excellence in productivity achievement.

The TAPPI productivity survey has been around for a long time. However, the 1995 edition is only the fourth year that it has been prepared and presented in its current format (1991–1993 and 1995). By current format, I am referring to the fact that the survey is oriented around key performance data measurements that are commonly used in the industry. Previously, the survey reported efficiency-type percentages, which were based on standards that were not always current, meaningful, or easily understood. As such, it appealed to a limited audience that could interpret the results (e.g., industrial engineers). In its current format, the data show actual results attained using common productivity measures that are meaningful to everyone in the industry and can be easily interpreted relative to results that are being achieved at your own boxplant. Examples of these productivity measures are square feet (or square meters) per hour, pieces per hour, man hours per 1000 square feet (or 1000 square meters), minutes per setup, downtime, crew size, etc.

The published report contains much data. The intention of this article is to ensure that everyone who uses the report understands how it was developed and what the results mean, and to give a few examples of how the data can be manipulated to provide some information that may be specific to an individual's needs. Copies of the published report for the 1995 survey are available through TAPPI PRESS. In addition to the published report, a disk is also available. With this disk and a spreadsheet-type software program, it is then possible to perform some additional analysis on the data, similar to what I refer to in this article. Note: The next productivity survey will be published in late 1997.

Why would anyone want to look at all those numbers and pieces of information that are included in the approximately 150 pages of the document? My answer to this question is another question—How does my productivity result measure up to what is being achieved in other plants in the corrugated industry?

There is no simple answer to this question of performance evaluation. Nevertheless, this question continues to be asked by operating crews, plant supervision, plant management, and corporate management. As companies strive for continuous improvement, there is a need to know not only if current results are improving, but also if the results are keeping pace with the rest of the industry. Additionally, as companies attempt to determine benchmarks for their future success, there is a need to know how the "top performers" are doing.

How is excellence in productivity performance evaluated? Is it the shortest setup times? Is it the highest volume (square feet, square meters, fed sheets) per machine hour or per man hour? If there were a single answer to this question, then the task of reporting productivity would be a simple one. However, the reality of productivity measurement is such that each display of results leads to a further question or request for more data to determine if the results are applicable to specific conditions.

The Productivity & Waste survey provides a substantial amount of information to help answer these questions. Key performance indicators that are commonly used in the industry are presented to allow each box maker to interpret the results in relation to the situation and circumstances at that plant. By situation, I am referring to the machine specifications. Does the machine have all the "bells and whistles" that are currently available to help improve throughput? Or, does it have only some or none at all? By circumstances, I am referring to that infamous variable known as "product mix," or more specifically, average order size and average blank size.

#1	#2	#3	#4	#5	#6	#7	#8	#9										
1000 ft² per total mach. hour	1000 ft² per setup	Avg. width, ft	Man-hour per 1000 ft²	Lin. ft per total mach. hour	Lin. ft per run mach. hour	Lin. ft per slitter turn	Code no.	Machine specs.										
224.3	161.2	6.65	0.018	33,720	36,073	16,038	8335	0	0	2	2	-	R	K	P	-	N	T
204.4	166.3	6.77	0.020	30,195	33,159	22,016	5556	0	0	2	2	0	R	K	P	W	O	T
200.0	151.3	6.78	0.020	29,508	32,954	11,684	3600	0	0	2	2	S	R	K	P	-	-	T
199.1	99.9	7.25	0.023	27,450	29,276	13,491	9542	0	0	2	2	S	R	K	P	-	-	T
196.5	117.4	7.88	0.024	24,937	26,412	10,154	5853	0	1	1	2	S	R	K	P	W	-	T
191.6	128.3	6.93	0.036	27,652	29,559	2,822	3309	0	0	2	2	S	R	K	P	-	-	-

#10	#11	#12	#13	#14	#15	#16	#17	#18
Avg. crew	Down-time, %	m² per total mach. hour	m² per setup	Avg. width, m	Man-hour per 1000 m²	Lin. meter per total mach. hour	Lin. meter per run mach. hour	Lin. meter per slitter turn
4.1	6.5	20,834	14,974	2.03	0.199	10,278	10,995	4,889
4.0	8.9	18,992	15,452	2.07	0.211	9,204	10,107	6,711
4.0	10.5	18,579	14,059	2.07	0.214	8,994	10,045	3,561
4.5	6.2	18,498	9,281	2.21	0.242	8,367	8,923	4,112
4.7	5.6	18,256	10,903	2.40	0.257	7,601	8,050	3,095
7.0	6.5	17,798	11,915	2.11	0.391	8,428	9,010	860

NOTES:

#1 1000 ft² per total mach. hour OR #12 m² per total mach. hour: key productivity measure. This is the reported "Corrugator production area" divided by the "Total machine hours" reported.

#2 1000 ft² per setup OR #13 m² per setup: measure of average order size. This is the reported "Corrugator production area" divided by the number of "Wet-end setups" reported.

#3 Avg. width ft OR #14 Avg. width meter. This is the reported "Corrugator production area" divided by the "Corrugator production lineal" reported.

#4 Man-hours per 1000 ft² OR #15 Man-hours per 1000 m². This is the reported "Corrugator man-hours" divided by the "Corrugator production area" reported. The result is multiplied by 1000.

#5 Lin. ft per total mach. hour OR #16 Lin. meter per total mach. hour: measure of overall average speed. This is the reported "Corrugator production lineal" divided by the "Total machine hours" reported.

#6 Lin. ft per run mach. hour OR #17 Lin. meter per run mach. hour: measure of average speed while running. This is the reported "Corrugator production lineal" divided by the "Productive machine hours" reported.

#7 Lin. ft per slitter turn OR #18 Lin. meter per slitter turn: measure of product mix. This is the reported "Corrugator production lineal" divided by the number of "Slitter turnovers" reported.

#8 Code no. This is the confidential number assigned to each participating plant. The identity of the plant is revealed only to the participant.

#9 Machine specs.: How the machine is equipped. This is a summary of the reported machine specifications. To determine the meaning of each code letter, refer to the sample survey questionnaire form.

#10 Avg crew: operating people on the machine. This is the reported "Corrugator man hours" divided by the "Total machine hours" reported.

#11 Downtime %: Portion of total time that the machine is not producing. This is the reported "Downtime machine hours" divided by the "Total machine hours" reported. The result is multiplied by 100 to express it in percentage.

I. Corrugators greater than 78 in. (1980 mm) and less than or equal to 90 in. (2280 mm) (CORY)

The survey report provides this type of information along with production rates, setup times, downtime, crewing, and other data for corrugators, flexo folder gluers, diecutters, printers, and most other operations in the industry.

In this article, I summarize the methods used to obtain the data for the survey report and follow with an explanation of the data that are included. Examples of some of the results are shown as well as an example of how the data can be manipulated based on different criteria.

HOW WERE THE DATA OBTAINED FOR THE 1995 EDITION OF THE SURVEY?

The 1995 survey was conducted and prepared with the substantial assistance of the Fibre Box Association (FBA). The FBA printed the survey questionnaire forms and mailed about 15,000 to all previous participants, to other member companies of the FBA, and to certain individual TAPPI members. Companies were invited to participate by completing the questionnaires using production data for the month of June 1995 and were to return the completed forms to the FBA. Participation is voluntary and simple and required submission of straightforward production data that are commonly collected in box plants.

The data submitted by each participant are kept confidential. Each participant was assigned a code number by the FBA; this code is only revealed to the submitting location. All compiled data and the data analysis results are identified and compared using only the assigned code number. Upon receipt of the completed forms, the data were screened for errors. The majority of data received from participants was of good quality. However, considering the large number of individual data items submitted, it was inevitable that some questionable data would be received. Efforts were made to identify, review, and correct these types of data. In some cases, the data were referred back to the submitting plant for its review and possible correction. Lacking a response, the data were left as submitted, but in some cases, the data were omitted entirely from the report if they were obviously outside the limits of exceptionally high or low results.

WHAT IS CONTAINED IN THE REPORT?

For the corrugators, the results are displayed in tables that contain 18 columns. For illustration purposes, Table I has the columns numbered. Columns 1–7 show the results in English units, and columns 12–18 are the metric equivalents. For the converting machines (Table II), there are 16 columns in the tables; four are in English units that are repeated on the right side in metric terms.

TOP PERFORMERS AND EVALUATION OF SELECTED RESULTS

Throughout the report, reference is made to the results achieved by the "top 15%." This is an attempt to try to isolate the top performers among the participating plants using a convenient method for quick reference. Different reference points can be developed that may be more pertinent to the local circumstances.

A useful way to evaluate the results obtained from the survey involves sorting and manipulating the results based on criteria that are meaningful to your company. For example, in the 1995 survey report, the results for corrugators greater than 78 in. (198 cm) and less than or equal to 90 in. (228 cm) (coded as CORY) showed the results tabulated in Table III for average speed per total machine minute.

This indicates that the top-performing machines in the industry have a productivity level that is 31% higher than the average performer. If your corrugator had a productivity level that was close to the overall average, you may surmise that it is necessary to improve by 31% to enter the top 15% ranks. However, by sorting the data and grouping them into percentile categories, it may be possible to set some more realistic targets for your machine.

In the example shown in Table IV, category A refers to the results achieved by the top 15% of participating plants, category B refers to the results achieved by the next 10% of plants, category C refers to the results achieved by the next 25% of plants, category D refers to the results achieved by the next 25% of plants, and category E refers to the results achieved by the bottom 25% of plants.

Again, if your corrugator were achieving 341 feet (104 meters) per minute, which is the overall average, it would now require an improvement of 22% to get into category A (top 15%) instead of the previously mentioned 31%. Alternatively, it would require an improvement of about 16% to move into the next-higher category (B).

Using the data presented in the survey report, similar analyses can be done using your own criteria, perhaps another productivity measure that is more appropriate for your company and circumstances (e.g., square feet or meters per machine hour, productivity per man hour, etc.), sorted by how machines are equipped. This can be done not only for the corrugator but also for all the converting machines included in the survey.

There is no simple answer to the question of performance evaluation. Your performance must be evaluated in terms of your mix of work, your machines and how

#1	#2	#3	#4	#5	#6								
1000 ft² per total mach. hour	1000 ft² per setup	ft² per piece	Man-hour per 1000 ft²	Code no.	Machine specs.								
79.8	239.9	6.4	0.038	2651	3	-	Z	-	P	-	L	S	-
49.0	101.6	5.4	0.041	5890	2	-	-	C	P	-	L	-	-
47.6	90.1	6.3	0.062	9277	2	-	-	C	-	-	L	S	-
46.1	156.7	7.1	0.044	6459	3	-	-	C	P	E	L	-	R
46.0	160.8	6.4	0.052	2085	2	-	-	C	P	-	L	-	R
43.8	156.8	6.3	0.054	2085	3	-	-	C	P	-	L	-	R

#7	#8	#9	#10	#11	#12	#13	#14	#15	#16
Pieces per total mach. hour	Pieces per run mach. hour	Pieces per setup	Minutes per setup	Avg. crew	Down-time, %	m² per total mach. hour	m² per setup	m² per piece	Man-hour per 1000 m²
12,543	14,276	37,738	15.1	3.0	3.8	7,409	22,292	0.59	0.41
8,995	10,815	18,654	20.9	2.0	0.0	4,551	9,438	0.51	0.44
7,517	10,022	14,242	19.3	3.0	8.0	4,418	8,370	0.59	0.67
6,449	8,476	21,938	27.1	2.0	10.7	4,280	14,562	0.66	0.47
7,154	8,044	25,038	23.2	2.4	0.0	4,270	14,943	0.60	0.57
6,947	7,923	24,877	26.0	2.4	0.2	4,067	14,564	0.59	0.58

NOTES:

#1 1000 ft² per total mach. hour OR #13 m² per total mach. hour. This is the reported "Surface area" divided by the "Total machine hours" reported.

#2 1000 ft² per setup OR #14 m² per setup: order size. This is the reported "Surface area" divided by the "Number of setups" reported.

#3 ft² per piece OR #15 m² per piece: average blank size. This is the reported "Surface area" divided by the "Production quantity" reported.

#4 Man-hour per 1000 ft² OR #16 Man-hour per 1000 m². This is the reported "Man-hours" divided by the "Surface area" reported. The result is multiplied by 1000.

#5 Code no. This is the confidential number assigned to each participating plant. The identity of the plant is revealed only to the participant.

#6 Machine specs. This is a summary of the reported machine specifications for some of the converting machines. To determine the meaning of each code letter, refer to the sample survey questionnaire form.

#7 Pieces per total mach. hour: overall average speed. This is the reported "Production quantity" divided by the "Total machine hours" reported.

#8 Pieces per run mach. hour: average speed while the machine is running. This is the reported "Production quantity" divided by the "Total run hours" reported.

#9 Pieces per setup: order size. This is the reported "Production quantity" divided by the "Number of setups" reported.

#10 Minutes per setup. This is the reported "Setup hours" multiplied by 60 and then divided by the "Number of setups" reported.

#11 Avg crew: operating people on the machine. This is the reported "Man hours" divided by the "Total machine hours" reported.

#12 Downtime %: portion of time that the machine is not producing or setting up. This is the reported "Downtime machine hours" divided by the "Total machine hours" reported. The result is multiplied by 100 to express it in percentage.

II. Flexo folder-gluers less than or equal to 28 in. (710 mm) x 72 in. (1830 mm)

	Linear ft/min	Linear m/min
Top 15% average	445	136
Overall average	341	104

III. Average speed per total machine minute

Category	Linear ft/min, range	Linear m/min, range
A	416–747	127–228
B	397–415	121–126
C	341–396	104–120
D	294–337	90–103
E	71–292	22–89

IV. Productivity results

they are equipped (e.g., automatic slitters, stackers, prefeeders, load formers, etc.), crewing, etc. Compared to industry experience, question on a constructive basis the areas where improvements can be made, identify clear and precise targets, establish a realistic program for their achievement, and evaluate the progress toward accomplishment of the objectives. The productivity survey can serve as a convenient and useful guidepost to answer many of your questions and point the way to excellence in productivity achievement. TJ

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