of this predictor may be questionable: Retail spending depends on consumer optimism, an intangible variable.

Other intangible variables are also indicators of change in the newspaper business, according to Frank Bennack, Jr., president and chief executive officer of the Hearst Corporation (Gersh, 1989a). The changing role of women, the aging of the population, growing illiteracy, and technological changes all affect newspaper readership and newspaper economics.

Richard L. Vaughn, executive vice-president and corporate director of research and planning at Foote, Cone & Belding Communications, Inc., believes that some of the newspaper industry's woes may stem from the unsteady and confusing transition to a new era of electronic media. Vaughn believed that newspapers will have an important role to play in this new media world, but it will be a different role (Gersh, 1989b). According to Hearst's Bennack, research is the key to understanding the significance of these changes and being prepared for the future.

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Measuring and Engineering Personnel Productivity in the Graphic Arts Industry

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This article considers means for measuring the productivity of personnel in firms in the graphic arts industry and for using such data as a means of tracking and improving performance of individual firms and the industry as a whole. We introduce several powerful means of analysis and explore the problems, issues, and benefits of these analyses using examples from the Finnish graphic arts industry.

The graphic arts industry includes traditional print media such as newspapers, magazines, and books, as well as advertising papers and materials and other commercial printing activities. Aside from its social, political, and cultural import, the industry is important to national economies because it plays an important role in conveying commercial information and promoting consumption of products and services. It is also often a major employer and contributor to overall economic activity through its own activities.

Although the graphic arts industry has traditionally been more economically stable than other industries, the development of new printing technologies, the internationalization of the industry, rising costs, and increased printing capacity are forcing managers to wrestle more directly with issues of competitiveness and business economics. In this environment, it is becoming even more critical to understand the issues of productivity in individual firms as well as the collective performance of national industries. A variety of financial and economic indicators are used to gain an understanding of industries and the performance of firms. Three critical types of data

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involves the scope and size, productivity, and profitability of the industry as a whole, as well as individual firms.

A number of indicators provide significant information on the size of a nation's graphic arts industry and its importance to a nation's economy. These include elements such as the number of establishments, number of persons employed, investments, value of production, and amount the industry contributes to a nation's gross domestic product.

Productivity is a measure of the amount of output created by inputs such as capital and labor. The most useful indicators for measuring productivity are net result percentage and value added per employee or per wage. Value added is a measure extracted from turnover after the costs of the produced materials are subtracted. The value added per employee indicator is used because it includes both general employees and managers. This indicator thus measures the whole organization's work productivity (Prokopenko, 1987).

Profitability measures the success of companies' business operations. The most useful profitability measures are net result percentage and return on investment. The net result percentage is calculated by dividing net profit by total turnover and is used because it shows—when positive—that a firm has succeeded in covering not only direct production costs but also the financing costs and depreciations with its income. Another measure of profitability, return on investment, takes into account the degree to which a firm is effectively using its invested capital (Horagren & Foster, 1992).

By using various combinations of these measures, one can produce clear overviews of the productivity and performance in national industries and use these figures to make cross-national comparisons as well. At the firm level, these measures then can be used by managers to make strategic decisions to improve productivity in future activities. This article explores methods of using these means of analysis in the graphics arts industry and introduces several useful means of using the results for greater understanding of the condition of firms in the industry, including industry segmentation and risk analysis techniques.

INDUSTRY MEASUREMENT USING A FINNISH EXAMPLE

The Finnish graphic arts industry is used in this article to provide an example of how such measures can be made. We used indicators in data from national industrial statistics (Yearbook of Industrial Statistics, 1976–1992), the annual statistics of the industry in Finland (Statistical Facts of the Graphic Arts Industry in Finland, 1991–1992), and a financial information database of industry firms (Annual Economic and Financial Statistics of the Graphic Arts Industry).

A review of the indicators shows that the industry expanded and enjoyed significant growth in the 1970s and 1980s. In 1990, the industry included 2,300 firms. The industry enjoyed relatively steady economic growth from the mid-1970s to the end of the 1980s. In real terms, the value of production rose 80% from 1975 to 1989. In 1991, the value of production was 17 billion Finnish marks, approximately $2.9 billion. In 1992, the graphic arts industry accounted for 6.7% of Finnish industrial production and 8.9% of industrial employees. It contributed 3.3% to the gross domestic product (Yearbook of Industrial Statistics, 1976–1992).

The Finnish graphic arts industry has traditionally been a home-market business, and the value of both its exports and imports has been marginal. In 1991, imports were 3.7% of turnover, and exports accounted for 4.5% of turnover (Statistical Facts of the Graphics Arts Industry in Finland, 1992).

Using statistics from the national statistical center (Yearbook of Industrial Statistics, 1976–1992), it is apparent that the industry made significant and increasing capital investments annually after 1975 (see Figure 1). These investments were primarily made in presses, prepresse and postpress equipment, and new buildings in which to house these investments. Such investments would be expected to produce labor savings that would result in increased productivity per employee. The results of the invested capital in the Finnish situation, however, did not produce comparable increases in productivity, a significant anomaly. One would normally expect that an increase in capital would result in an increase in productivity by increasing the average output per employee or the efficiency of employees so that the number of employees needed could be reduced. One would also expect that managers would make investment decisions based on the concept of producing regular productivity increases that generally run parallel to capital growth.

The results show, however, that these expectations were not achieved because managers continued capital investment even when it produced no increases in productivity. Strategic choices in the industry also tended to favor increasing prices over increasing productivity. As a result of the economic downturn and declining markets experienced in recent years, this option is no longer available. Nevertheless, it is clear that managers pursued this policy even during the economic downturn that began around 1988, thus aggravating sales and apparently resulting in the decrease in productivity shown after that time (see Figure 1). This pricing policy can be seen in the fact that the graphic product price index rose 34% from 1985 to 1991 (Statistical Facts of the Graphic Arts Industry in Finland, 1992).

Because the Finnish industry statistics are organized in a database that contains the performance of a sample of 135 firms (Annual Economic and Financial Statistics of the Graphic Arts Industry), it is possible to analyze the industry in greater depth to determine the impact of the investment pattern and cost decisions on productivity and profitability. To do so, we produced a scatter graph using productivity and profitability indicators for firms in 1992 as the axes (see Figure 2). The axes are drawn according to the net result percentage, using 0% return as the middle point, and the average value added per employee (250,000 Finnish marks).
Graphing the firms in such a manner divides them into four groups indicative of their economic conditions. We chose to name the positions of the firms in these quadrants as the swamp, the capital cemetery, the kindergarten, and the business class. The swamp contains firms with low productivity and low profitability, and it receives its name because of the lack of efficiency and productivity begins to pull firms deep into the mire and, over time, can result in a firm submerging into catastrophe. Using the standardized Z test (Rees, 1990), we determined that approximately one half of the graphic arts firms in the swamp were classified as probable cases for bankruptcy. The capital cemetery contains firms with high productivity but low profitability, and its name reflects the burying of capital through unnecessary and unproductive investment. The kindergarten receives its name because it contains firms with low productivity but high profitability. These firms are typically able to produce profits because they lack mature competition and operate as monopolies. The business class contains firms with high productivity and high profitability, and it reflects its members’ elite status as effective and well-managed enterprises.

Dividing the firms merely by average productivity and profitability, however, can be somewhat misleading because doing so ignores the fact that some of the results may be atypical, temporary, or single-year results created by specific business decisions or uncontrollable national economic conditions. Some firms located in undesirable quadrants may actually be very close to the average performance of the industry. Thus, a better indicator of the condition of specific firms and the industry as a whole is achieved by adding indicators of 1 standard deviation distance from the average axes. In this case, the net result percentage produced a standard deviation of 13, and the value added per employee had a standard deviation of 140. When the firms in the study of the Finnish industry are plotted in this matter, one finds—as expected—that the majority of the firms are within 1 standard deviation (see Figure 3). The remaining outlying firms show signs of unusual strength or weakness, and these are the firms that deserve special attention from a management or industry analysis standpoint.

Although segmenting the industry by using standard deviation—a measure used primarily to reduce the probability of error—is statistically accurate and a reasonable choice for analysis, it produces somewhat artificial results when considering productivity measured by value added per employee. This occurs because no informed or competent manager would knowingly permit value added per employee to drop below the average combined costs of wages and benefits for an employee. To adjust for this problem, we concluded that the lower parameter in classifying the firms should be the combined costs of wages and benefits for an average employee, in this case 196,000 Finnish marks. As shown in Figure 4, the differentiating line moves above where it was positioned by standard deviation, thus revealing the critical position of even more of the firms in the bottom cells of the quadrant.
Having clearly identified the four distinct groups, one can then conduct a risk analysis with key indicators of economic and financial strengths. The key indicators and the limiting values typically used in risk analysis (result after taxes and interest, solidity, debt/turndown, and quick ratio) are normally used to group firms as "outstanding," "sufficient," or "at risk" (van Horne, 1992). These four groups could be used to produce four different risk analyses of the firms in each of the four quadrants previously identified. We chose, however, to exclude two of the indicators—debt/turndown and the quick ratio—because they are transitory measures that can rapidly change from day to day or quarter to quarter and are not germane to the type of analysis being performed here. This left the two most powerful indicators—result after taxes and interest, which is an indicator of success or failure during the year analyzed; and solidity, which measures the equity of a firm against total capital, indicating the financial strength of the firm. We used the traditional segmenting limits in employing these measures.

<table>
<thead>
<tr>
<th>Result after taxes and interest</th>
<th>At Risk</th>
<th>Sufficient</th>
<th>Outstanding</th>
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<tr>
<td>&lt; 0%</td>
<td>0%–5%</td>
<td>&gt; 5%</td>
<td></td>
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<td>&lt; 20%</td>
<td>20%–40%</td>
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This type of analysis reveals the stability of the firms found in each quadrant. The differences between the most opposite quadrants—the swamp and the business class—are readily apparent in terms of the number of firms at risk. The capital cemetery and kindergarten quadrants represent gray zones in which the positions of firms are less clear. The two measures provide different views of the condition of the firms in the quadrants because result after taxes and interest is based only on 1 year's performance, whereas the solidity measure reveals the overall strength of the firm that is the result of business decisions and its performance over a longer period of time. The results of the risk analysis using both tests show a similarity in trends in the quadrants (see Figures 5 and 6) for the 2 years reported in each analysis. As expected, the 1-year measure (result after taxes and interest) slightly underestimates the extent of problems and overestimates successful operations.

Figure 5 reveals general stability in the industry in terms of result after taxes and interest between 1991 and 1992, but it reveals that a significant number of firms in the capital cemetery moved into the at-risk category. In the swamp quadrant, a large number of firms moved from the at-risk and the outstanding to the sufficient category, whereas in the kindergarten quadrant a significant number of firms moved from the sufficient to the outstanding category.

In terms of solidity, Figure 6 shows general stability but a movement of both at-risk and outstanding firms to the sufficient category in the capital cemetery and swamp quadrants. In the business class quadrant, firms in the
sufficient and outstanding categories slid downward to the at-risk and sufficient categories. In the kindergarten quadrant, at-risk and sufficient category firms both moved upward.

STRATEGIC IMPLICATIONS

The analysis just performed provides useful insight into the state of the industry as a whole. It also provides critical information by which the managers of individual graphic arts firms can compare their performance to others in the industry. This analysis provides means of assessing the outcomes of managerial choices as well as the competitiveness of firms against other firms at the national and international levels.

Obviously, managers can find that their firms' productivity levels reveal inefficiency or that their companies are located in the swamp quadrant in terms of productivity and profitability. If this is the case, and they have a significant number of risk factors placing them in the at-risk category, they obviously must act decisively and rapidly in planning strategies and implementing actions for survival.

Managers of firms that are not in the least desirable quadrants and categories, however, can use such analysis as a benchmark of their performance to plan strategies for improvement or for maintaining a desirable position and tracking their performance vis-à-vis others in the industry over time.

The most significant strategic use of such information, however, comes through use of the various analysis techniques for productivity planning by individual firms. Differing degrees of productivity are not merely the results of mathematical calculations but the results of managerial decisions. By understanding the position of a firm and industry, a manager can respond to changes in the economy and make informed decisions about personnel and investments (Heap, 1992). Such decisions should involve planning for productivity and its concurrent effects on profitability.

In planning personnel decisions, managers can influence both the number of employees and the value added per employee. Responding to strategic plans and short-term needs, managers can make choices to increase, decrease, or maintain the same number of employees and value added. We created a personnel productivity decision matrix in which these choices can be plotted and desirable outcomes engineered. Managers' choices involving employees and value added produce nine different outcomes that can be achieved by deliberate strategy or the inattention of managers (see Figure 7).

The most desirable outcome, of course, is to decrease the number of employees while increasing the value added per employee, thus increasing costs but achieving more productivity (see lower left cell of Figure 7). This outcome can rarely be achieved by itself and almost always involves the strategic acquisition of new equipment through capital investment that permits a reduction in personnel or significant reorganization of the workplace and work activities. At the opposite end of potential outcomes is an increase in personnel occurring with a decrease in value added per employee (upper right cell). Such an outcome will rapidly create a profitability crisis and must be changed immediately, or survival of the firm will become doubtful.

Six other potential outcomes may occur unintentionally or as the result of management actions undertaken for a variety of efficiency and strategic reasons, but the seventh—the middle cell—is undesirable if it is sought or maintained too long because it signifies a satisfaction with the status quo and the lack of strategic direction that in time will leave the firm behind while innovative, competitive firms are pursuing other outcomes. It can, however, be used as a short-term strategy while planning for change and growth.

When the choices and performance of firms in the Finnish graphic arts industry, comparing 1991 with 1992, are placed into this matrix, one can easily see reasons for productivity and profitability difficulties many firms are experiencing (see Figure 8). Of the Finnish firms, nearly 50% maintained 1991 staffing levels and 12% increased their number of employees despite declining sales throughout the industry. In terms of value added per employee, 25% of the firms experienced a decrease in value added, 31% of the firms had value added remain the same, and nearly 44% experienced an increase in value added per employee.
Managers who track the productivity and profitability performance of their firms over time can gain a powerful tool for understanding the results of their personnel decisions and begin to engineer productivity by pursuing strategies with regard to employment and capital investment. When aggregated national data and productivity analyses are also available, managers can compare their firms’ performance to those of other firms to help gain understanding of their level of competitiveness in terms of productivity.

Managers and analysts, however, should not make binding conclusions about the condition of firms based only on a single use of these analyses because the power of such analyses rests in their use over time. A firm that pursues a downsizing or status-quo strategy, for example, may be doing so only as a short-term strategy to improve profitability and to make strategic plans for increased productivity or market expansion in the near future. The most positive and negative strategic locations, however, readily reveal significant problems or innovative and aggressive management designed to improve the performance of the firms.

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