PIMS: the “unprofitability” of modern technology

Good Of all the findings on business strategy yielded by the study of the businesses in the PIMS database, the following is one of the most controversial: Businesses that are highly investment intensive, i.e., those that use high levels of investment per dollar of sales revenue (telecommunications network providers, bulk chemical companies, airlines), are much less profitable than businesses with lower levels of investment per dollar of sales.

This finding is controversial not because the phenomenon is rare, uncertain or weak – it is common, quite clear and extremely powerful – but because it is so unexpected. The conventional wisdom is that there is a strong positive relationship between investment intensity and “modernity” or “progressiveness”.

Everyone knows that modern technology requires elaborate machinery, and thus heavy investments, and that high labour productivity depends on extensive automation, and thus on heavy investments. Since modern technology and high labour productivity are judged to be “good” things, they are expected to improve profitability rather than hurt it.

The basic fact
Figure 1 shows the “unprofitability” of modern technology, in terms of ROI:

Figure 1

<table>
<thead>
<tr>
<th>Inv/Sales %</th>
<th>ROI %</th>
</tr>
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<tbody>
<tr>
<td>&lt; 25</td>
<td>50</td>
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<tr>
<td>25-50</td>
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<tr>
<td>50-75</td>
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<tr>
<td>75-100</td>
<td>25</td>
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<tr>
<td>&gt;100</td>
<td>15</td>
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</tbody>
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Senior Partner at Malik PIMS® London
keith.roberts@malikpims.com

Keith Roberts is Senior Partner and the world’s foremost authority on PIMS® – using evidence to improve business management. He studied statistics at Cambridge University and has worked – both within companies and as a consultant – on the strategic transformation of dozens of major companies in oil, chemicals, paper, packaging, FMCG, media, hi-tech and engineering in 53 countries and 6 continents.
Referring to Figure 1, "investment" includes both working capital and fixed capital (at net book value). The figures reported in this article are four-year averages. With a different definition of investment (e.g., pre-depreciation book value or current replacement value) or a different performance index (e.g., profit as a percentage of value added) or a different time period (e.g., three years or five years), the specific numbers are moderately different, but the strategic message is the same.

What in fact happens is that (a) the commonly expected public benefits of investment-intensive technology (higher wages, lower prices, and improved product quality) do indeed occur most of the time, but, alas, (b) the expected private benefits do not occur; instead, the profits of companies utilizing an investment-intensive technology are usually rather poor.

Why does investment intensity hurt profits?
Before answering that question, it is important to confirm that this is an issue that is real and substantive, not just an optical illusion. For example, it might be argued that the negative pattern in Figure 1 is due entirely to arithmetic: that investment-intensive businesses have large denominators in their ROI ratios, and that their returns are low for that reason alone. That possibility can be excluded by using another measure of profitability. For example, Figure 2 relates investment intensity to the ratio of Residual Income to Sales. "Residual Income" equals pretax operating income less a financial charge of 10% on the investment used in the business. (Other rates of financial charge produce different slopes but the same basic pattern. Even so unrealistic an assumption as a zero cost of money produces a slightly negative slope). The similarity of the pattern to that of Figure 1 confirms that investment-intensive businesses are actually less profitable.

Another possible argument is that the negative effect of investment intensity is actually due to something quite different. Specifically, it is well known that businesses with high shares of their served markets are considerably more profitable than those with low shares. One of the reasons for that relationship is that high-share businesses tend to be more efficient users of investment and are therefore less investment-intensive, while low-share businesses are often inefficient users of investment and are therefore more investment-intensive. The negative effect on profit of high investment intensity might therefore be no more than the reverse side of the coin of the favourable effect on profit of high market share. To exclude that possibility it is necessary to establish that there is an effect on ROI from investment intensity in addition to that from market share. Figure 3 shows that there is indeed such an effect.

Figure 3

ROI %

- <13%
- 13%-28%
- >28%

Market Share Avg

The ROI number in each category is the four-year average for the businesses falling into that category.

All the businesses in a given column have similar market shares, but, going down a column, investment intensity goes up. That fact that ROI decreases sharply as moving down each column confirms that investment intensity has a negative effect on profit, regardless of market share. It has also been examined, within each of the classes of investment intensity, not only ROI itself but also the degree to which the ROI of the group of businesses is lower or higher than would be expected from their levels of market share alone. It does in fact turn out that investment-intensive businesses are even less profitable than would be expected from their market share, further confirming the phenomenon as a real and important one.
A third argument might be that low ratios of sales to investment (i.e. high levels of investment intensity) are actually due to low levels of capacity utilization. A similar test of this hypothesis yields a similar result.

**Why does it happen?**
The major reason for this negative effect seems to be that the game of competition is played in a very different way in investment-intensive industries than in others. When each of the firms competing in a particular industry has committed heavy investments on which a reasonable return needs to be earned, each becomes rather eager to keep its capacity loaded. In an investment-intensive facility, volume is commonly believed to be the key to profitability. (Perhaps surprisingly, this belief is as common in industries where the investment consists largely of working capital as it is in those where the investment is largely fixed capital.) The competitive process in investment-intensive industries readily degenerates into a volume grubbing contest, punctuated with frequent price wars, marketing wars and other over-intensive competitive measures that take most of the joy out of being modern, automated or otherwise investment-intensive. In particularly good years, when every company’s capacity is almost fully loaded, this effect may not appear at all, but when good years are averaged with bad, as in the exhibits presented here, the negative effect on profit is quite clear.

Figure 4 demonstrates this by plotting the “price cost gap” (difference between % p.a. selling price growth and a weighted average of % p.a. labour rate growth and % p.a. material cost growth) as a function of investment intensity. The gap is usually negative (prices get squeezed relative to cost inflation so require offsetting productivity gains). The squeeze is most severe for investment intensive businesses.

The profit-depressing price squeeze also shows up clearly when we examine the value added per employee in industries that differ in their investment intensity. “Value added” is the degree to which a business upgrades the market value of the raw materials or components it buys, i.e., the difference in market value between what the business buys and what it sells.

Figure 5 shows that the value added per employee does not increase with added investment intensity over a surprisingly wide range.

**Figure 4**

<table>
<thead>
<tr>
<th>Price-cost gap</th>
<th>Inv/Sales %</th>
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<td>&lt; 25</td>
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**Figure 5**

Emp prod (2000$)

Note: The estimate of “value added” has been adjusted for abnormally high or low earnings.

It appears that employees working with the support of large investments produce no more value than those working with only small investments. How can this be? It is possible that the first group of employees is simply less productive as individuals, that they are less capable people? More likely, however, is that the more intensive price competition occurring in investment-intensive industries reduces the market value of their product, and hence the value added by their activities.

A closely related reason for the unprofitability of investment-intensive businesses lies in their apparent inability to manage their personnel levels in a suitable fashion. The number of employees per dollar of sales is nearly as high as in less investment-intensive industries. Higher numbers of people in other functions on average counterbalance the lower numbers in manufacturing functions.
Before we leave this subject, it is worth noting that our various exhibits have undoubtedly slanted reality in favour of investment-intensive businesses, and therefore have understated the magnitude of the problem. This bias occurs because our statistics are drawn from accounting records that are kept in the conventional way. Conventional accounting procedures overstate ROI, particularly of investment-intensive businesses, both by overstating the numerator and by understating the denominator. The reason is the same in both cases: fixed assets are valued at their historical cost, rather than at their current inflated worth, understating both depreciation costs (and thus increasing apparent earnings) and investment levels.

What to do?

If the technology of your business clearly requires a high level of investment intensity, either of plant and equipment or of working capital (or both), what actions should one take?

First Principle: Don’t automatically assume that more is better insofar as investment intensity is concerned. A highly automated plant is not necessarily a better plant than a less automated one, no matter how wondrous it may be to behold.

Of course, the recent series of cash crunches in the economy has already cured many executives of this knee-jerk reaction, but old habits die hard, particularly in industries such as bulk chemicals, where increased capital intensification has long been a way of life.

Most of us still unquestioningly assume that good technology is almost synonymous with automated production or long and full pipelines in distribution. And that assumption is valid just often enough in particular cases to save it from being wrong. However, the proverbial “hard look” is clearly justified with regard to all investments that are larger than proportional to an increase in capacity.

Second Principle: In evaluating a proposed investment which is clearly larger than proportional to a capacity increase, consider the strategic effect as carefully as the cost effect. A negative strategic effect may more than offset a positive effect on cost.

Suppose, for example, that you are considering a capital-intensifying project (say, an increase in the degree of automation of your plant) which, on the basis of conventional cost calculations, will have an annual operating cost, everything included, of $1,000,000, an annual saving of $3,000,000 in reduced labour costs or reduced spoilage, and therefore a net benefit of $2,000,000 per year.

Suppose further that all of these estimates are accurate, and that the net saving of $2,000,000 per year does in fact materialize as promised. Even then, the project may not be, and very frequently is not, profitable. Although, $2,000,000 would be saved, the $2,000,000 wouldn’t be kept. Instead, it would be given away, mostly to customers, secondarily to employees, and thirdly in the form of higher marketing costs. This would not be done out of choice. One would be forced to do it by changes in the competitive climate. First, the competitors’ and ones own increased desperation for volume (to keep those expensive plants with their high fixed costs loaded) leads to price and other concessions to customers, particularly after the new technology has become widespread; second, ones increased fear of plant shutdown leads to higher wage settlements and a greater reluctance to discharge unneeded people; and third, one may well be caught in more and more intense marketing wars. So, frequently the net effect of the new technology is that its benefits accrue to customers and to the labour force, while one is left with the costs and the investments. It is a very good deal for others, but not such a good deal for the investor.

Now, the message of this scenario is not, of course, that any capital-intensifying investment should automatically be rejected, but rather that its strategic effect should be estimated as carefully, before the event, as its cost effect. The net result, in many cases, will clearly be against the contemplated project, no matter how glamorous it may be. However, while the project may have a negative net prospect as far as percentage return on investment is concerned, it may quite often have a favourable prospect as far as dollar results are concerned, because the lower percentage is applied to a larger investment base. In such cases, a rather difficult management decision is required – difficult because it involves a trade off between an increase in sales and dollar profits on the one hand, and a decrease in the rate of profitability on the other.

Third Principle: Adopt a market strategy that minimizes the profit-damaging effect of capital-intensive technology.
The PIMS database suggests several ways to accomplish this, many of them leading to increased earnings, if not increased ROI levels or higher profits to sales ratios. Let us briefly examine three such moves.

The first is suggested in figure 3. If you look only at the bottom line, where the highly investment-intensive businesses are located, you will note a sharp increase in profitability as you move from left to right, from 2% average ROI to 10%. Even at approximately equal levels of investment-intensity, the high-share businesses do much better than the low-share businesses. This observation may seem rather obvious and unhelpful, until we remember that market share is measured relative to the served market, i.e., relative to that segment of the total potential market in which the business is operating.

“So, one way in which a business can obtain high market share is to concentrate its efforts on a segment of the total potential market.”

For example, a smaller geographic area or a more specialized class of customers, in other words, to remain an equal size frog but in a smaller puddle. (Of course, if you can also manage to become a larger frog, so much the better, as long as the price of doing so is not too high.) Since market-segmentation efforts can often move a business toward the right on figure 3, market segmentation or redefinition is clearly one strategic answer to the profit-depressing effects of capital intensity. The recent histories of some segments of the specialty steel and pharmaceutical industries illustrate this principle.

A second approach is implied in figure 6. Here we are dividing businesses according to their investment intensity and breadth of their product line relative to their competitors.

When we focus on investment-intensive businesses in the bottom row, one can see that a product line that is broader than competitors’ is clearly preferable to one that is not. This observation can be combined with the previous one. An investment-intensive business can be quite profitable if it focuses on a relatively narrow and “conquerable” market segment, and covers that segment really well, with a broad and diverse line tuned to the preferences of that segment.

A third approach to profit protection in investment-intensive businesses is to be sure to obtain adequate productivity improvement for the increased investment. It has already been noted that productivity rises more rarely than one would expect, but where it does rise, it certainly helps. Figure 7 gives the key facts.

Summary Observations: Investment intensity, contrary to common expectations, has a negative impact on profits, in relation to both investment and sales.

» The major reason lies in the competitive climate associated with high capital intensity.

» An important secondary reason lies in the common inability of investment-intensive businesses to realize adequate savings in labor and other costs.

» There are market strategies that make an investment-intensifying move more profitable, or minimize the damage at least in monetary terms.

One of the major uses of PIMS’ models is to identify and calibrate such market strategies, both in general and insofar as they apply to specific businesses.
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Prof. Dr. oec. habil. Fredmund Malik
Chairman & CEO

Fredmund Malik, founder and chairman of Malik, is an acclaimed international management expert, awarded scientist, and professor of corporate management and governance at the University of St. Gallen, Switzerland. He is the award-winning author of a dozen bestselling books, including the classic “Managing Performing Living”, and a regular columnist in opinion-forming media. He is one of the leading and most innovative management thinkers of our time. Amongst others an expert in corporate governance, he is a member of the board of directors or advisory board of several world-leading corporations. Since the early 1990s, he has been the first in the German-speaking countries who discovered and consistently criticized the errors of neo-liberalism and of the shareholder value approach developing also the innovative right and proper solutions. Using his system-cybernetic methods and instruments, he was among the very first to predict and write about the current crisis, the Great Transformation21 and its complex challenges for which he has developed cutting-edge solutions.