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Forecasting change - 4 Paradigms stalled

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We can reliably predict the emergence of a new paradigm when we notice we've reached the limit of an old paradigm. New paradigms are constantly being created. However, these new paradigms are adapted to more quickly when old paradigms have reached their limits rather than when they are at their peak.

If current paradigm changes foretell major changes in the way we live and work, then it is probable that many of the current paradigms have reached their limits.

Proposition 3

New paradigms emerge when old paradigms reach their ceiling

A review of various fields of endeavour shows that this is indeed so. We have reached a plateau in many areas as the evidence on the next few pages shows (Paepke 1993). The patterns identified here apply mainly to developed countries (in particular the U.S.). The purpose is to show that, as a society advances, the paradigms on which the society is based reach their limits. We will examine several areas that were the focus of past growth. As discussed earlier, a number of paradigms have just reached-or are about to reach-maturity. Here we will briefly review how ceilings are being reached in different aspects of human endeavour.

Manufacturing ceiling

There have been tremendous advances in processing materials and a consequent decline in costs. Traditionally, productivity gains resulted in lower prices and increased output. This may no longer be the case. As Paepke (1993) points out, many major industries now operate at well below capacity-not only during recessionary periods but during periods of economic growth as well.

For example, the automotive industry can produce 15% more than the level of demand, even during growth years (The Economist, 1991). The steel industry can produce 25% more than the amount of steel being consumed. If the total capacity could be used the cost per unit would come down. However, the over capacity in many sectors, even during boom periods, shows that production is not supply driven any more, but demand driven. Consequently, output will likely stagnate.

There is one more aspect to consider. The cost of materials used in newer products such as computers and fibre optic cable are much lower than the cost of materials used in established products such as automobiles. Established products have a lower limit on how low the price can get; for newer products the cost of production-as compared to what it costs to the consumer-is so low that reducing production costs further is not likely to produce a tangible benefit to the consumer. If a computer that sells at \$5,000 costs \$500 to manufacture, slashing the cost of manufacturing by 50% will only save the consumer 5%.

The manufacturing labour force in North America has dwindled to 5% from over 30% of the total labour force just 70 years ago (Drucker, 1986). During the same time, the total output has risen several hundred percent. We produce much more with much fewer people.

Research and development ceiling

In 1920, total research and development spending was 0.1% of the gross national product. Spending rose to 0.7% in 1940. However, since the 1960s, it has been fluctuating between 2.3% to 2.8%. (Rescher 1991, Corcoran 1992). It appears that beyond a certain point spending on research and development results in no discernible product improvement. The number of scientists involved in research has also reached a plateau throughout the world (U.S. Department of Commerce, various years).

Food production plateau

Consider the number of hours needed to produce food (Exhibit 1).

Exhibit 1
Changes in hours needed to produce food

	<i>Hours needed to produce a given quantity in</i>	
	1925-29	1982-86
Wheat	100	5
Corn	100	3
Milk	100	6
Chickens	100	1

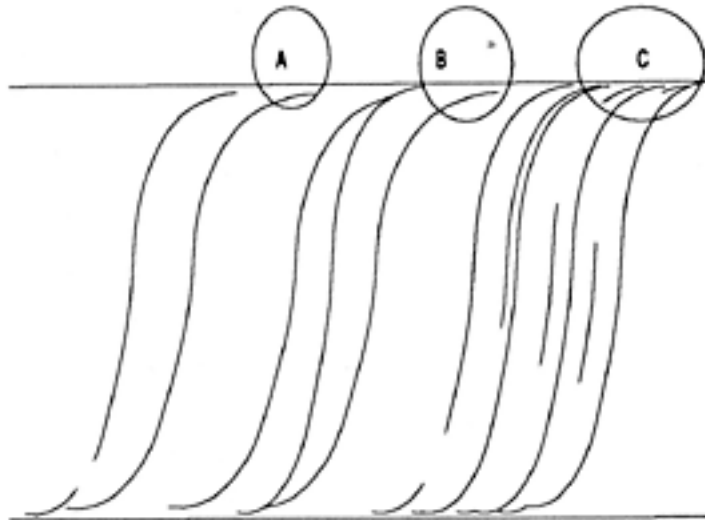
Derived from U.S. Department of Commerce (various years)

We are able to produce food in a fraction of the time it took us about 50 years ago. Improvements are still possible, but when we allow for physical factors involved in production, the gains are likely to be minor.

Construction ceiling

- During the early years of this century, there were only 200 miles of paved roads outside the large cities (Freeman 1988). Now new roads are seldom built because the country is so well connected.
- There is a glut of office space throughout the world- from Tokyo to Toronto, from New York to Melbourne. For several years now very little construction was undertaken to fulfil any shortage. New construction is undertaken now to improve the amenities available.

In advanced countries such as the U.S. and Canada, the growth in construction in the past two centuries has far exceeded the population growth. Advances in the process of construction itself, which include the use of iron and steel, reinforced concrete and power equipment, have also reached a plateau and no major new advances have been evident for many decades. The productivity of the U.S. construction industry is in fact no higher now compared to the U.S.'s productivity in 1948 (Feinberg, 1985).

EXHIBIT 2**MAJOR RECESSIONS OCCUR WHEN MAJOR PARADIGMS MATURE**

A: Recession of the mid 1800s; B: Recession of the 1930s; C: Recession of 1990s. Also note that each successive major paradigm includes more sub-paradigms which mature at approximately the same time.

Transportation ceiling

- Although cars have improved dramatically since the days of the Model T, the cost of a car has remained the same in real terms (in fact cars effectively have become much cheaper when we take into account the improved quality and the dramatically increased purchasing power of the buyers).
- While the technology is available to make aircraft faster, we have reached a plateau here as well. There appears to be no commercial demand for a faster aircraft. Most passengers take the Concorde more for the 'experience' than to save time. Since the time spent travelling to and from the airport, checking-in, going through security checks and waiting for baggage is a substantial portion of the total travel time, even if the air travel time is cut by say 20%, it may make only a marginal difference in total travel time, especially for shorter flights.
- The average speed of cars has stayed constant at 30 mph since the days of the Model T (U.S. Department of Commerce, 1976). Access to highways and speed improvements simply compensated for the increased traffic. It would appear that human beings do not want to travel any faster!

All this implies that the transportation sector has reached its limits in terms of speed (time). The technology needed for further improvements are already available but these changes appear to be of no interest to consumers.

Energy and power ceiling

The cost of residential electricity was about 30 cents in the 1920s. By the 1960s it dropped to about 7 cents. For the past 30 years it has been fluctuating around this price within a narrow range. Generators are highly efficient and no dramatic improvements are expected in the near future.

There appears to be no commercial demand for a faster aircraft. Most passengers of the Concorde are there more for the 'experience' than to save time.

Communications ceiling

It took four full days for the news about Wellington's victory to reach London (Paepke 1992). Even when quick transmission of information first became possible through long distance calls and telegrams, they were expensive and these methods of communication were used only selectively. Now news quickly travels anywhere in the world through cellular phones, faxes and other media. Even pictures of events can be transmitted practically

instantaneously around the world.

The impact of the ceiling effect

When a series of major paradigms reach their saturation levels, we face a recessionary economy. If we consider the past three industrial waves, we see how, as the paradigms of each wave reached their ceiling, major recessions set in: the recession of the mid-19th century, the recession of the 1930s and the current recession (illustrated in Exhibit 2). Since each industrial wave produces many more paradigms than the previous one, when the paradigms reach their ceiling at the end of each wave the recession tends to be deeper and more prolonged.

The fact that paradigms of the industrial revolution have been maturing over the past 20 years in developed countries is reflected in the dramatic slowdown of real GDP growth per capita in different OECD regions of the world (See Exhibit 3). The exhibit very clearly shows the slowdown of the pace of economic growth over the past 20 years.

EXHIBIT 3 DECLINE OF REAL GDP GROWTH PER CAPITA

*Average year over year % growth during***

	60-68	68-73	73-79	80-90
G-7 Countries	3.9	3.4	2.0	2.1
Smaller European count.	4.1	4.4	1.4	1.5
Australia/NZ	3.9	4.3	1.4	1.5
Total OECD	3.9	3.5	1.9	1.9
Average	3.8		1.9	

• Source: OECD Historical Statistics 1960-1990, Paris, France: OECD 1992.

** The OECD considers the grouping of years as shown on the table more meaningful than arbitrary grouping of years into consistent categories such as 5 or 10 year time periods.

While it appears that we have reached a ceiling in different areas of endeavour, it does not mean that no progress is possible. However, the progress ceases to be meaningful to consumers after a certain point. For example, when we compare mail with fax, the difference was not only dramatic but highly meaningful. What took two days to deliver can now be delivered in 2 minutes. If this speed were to increase dramatically-say delivery in 2 nanoseconds instead of two minutes-it is unlikely to deliver the same benefit to the consumer as the reduction to 2 minutes from two days. Considerable improvements are probably still possible in some of the areas we explored thus far. Yet from the consumer point of view, such improvements are likely to be seen as marginal since they don't carry additional utility for most consumers.

At this stage society has two choices: either invent new paradigms or stagnate and perish (as had happened in some older civilizations). I believe that we have chosen-as we have throughout history-to change our paradigms to new and much more powerful ones. The evidence at hand shows that very powerful paradigms are already underway.

Long cycles and age waves

There is additional evidence to support the view that we may be on the threshold of a major paradigm shift.

Long cycles

Kondratieff, a Russian economist, proposed a 50-year 'long wave' cycle. In simple terms, about every 50 years the long wave hits a trough (Kondratieff, 1935). When this happens, sweeping technological and institutional change takes place. As a result, products and the workplace undergo revolutionary changes.

- First long wave: Industrial Revolution followed by decline until 1875

- Second long wave: Second Industrial Revolution-Phase 1 - 1880-1930, followed by Great Depression continuing until WWII.
- Third long wave: Second Industrial Revolution-Phase II - 1940-1970 followed by the stagflation of the 1970s.

If we accept the existence of long waves, the theory indicates that another long wave is about to begin. We are now in the trough of this long wave and probably will remain there for the next few years before we encounter another prolonged period of prosperity.

The confluence of such factors-the death of the manufacturing paradigm, the long wave and the age wave-at a time when a new paradigm is emerging indicates that we are about to enter a new era of growth.

Age wave

The current long cycle also coincides with what is known as the age wave. The term 'age wave' is used here to mean the spending cycles of a given generation. Research studies show (Dent 1993) that spending by people peaks when they reach the age group 45 to 49. The large baby boom segment will be in this age group in the next few years, spurring a spending boom right at the time when the growth in information technology starts to accelerate.

The confluence of such factors-the death of the manufacturing paradigm, the long wave and the age wave-at a time when a new paradigm is emerging indicates that we are about to enter a new era of growth. This will be discussed further in subsequent issues of Imprints.

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