# While at Harvard Business School

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Abstract: *While at the Harvard Business School, it came to me that business with its information flow is much like a control system with its signal flow. In controls, it is signal flow. In business its cash flow. In control systems there is negative feedback to stabilize. In business the feedback is positive to assure growth and expansion. Inputs in control systems are commands. The output is controlled motion. In business the inputs are cash and the output is high value products and services. All this can be diagramed for business systems in the same way a control system can be block diagrammed. This paper is about the insights gained from the benefits of both of these points of view.*

## Introduction

While at the Harvard Business School, a number of the concepts taught there as discrete courses[1] came together in the form of a picture. The picture contained the fundamental elements of business: An Icon Diagram of Business.

When viewing this diagram, I remind my students and colleagues that a **well-crafted** visual model avoids labor spent in vain fighting language and definitions.

What is useful about this diagram is that it contains the structural elements of business on a single diagram, showing their location in relation to where they are relevant in business. This diagram is **self-explanatory,** requires little in the way of amplification to gain the following common sense insights:

Business begins with in infusion of capital from the capital markets.
The capital is transformed into value products and services of high value by (1) production assets purchased with loans, collateralized loans, from the bank, (2) labor from the labor markets and (3) raw materials from the suppliers markets. A "Great Idea" adds substantial value to the raw materials. Example: Given 2000 lb. of metal, 100 lb. of glass, 100 lb. of polymer foam, etc. an individual cannot make a car with engine and radio etc. by himself for $14,000 and do it in a few days. The concepts of production line learning, economies of scale, technology insertion and quality management are all great ideas that underlie the automotive the production of cars and trucks that an individual cannot do alone.

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[1] Finance, Production, Operations, Marketing and Strategic Management
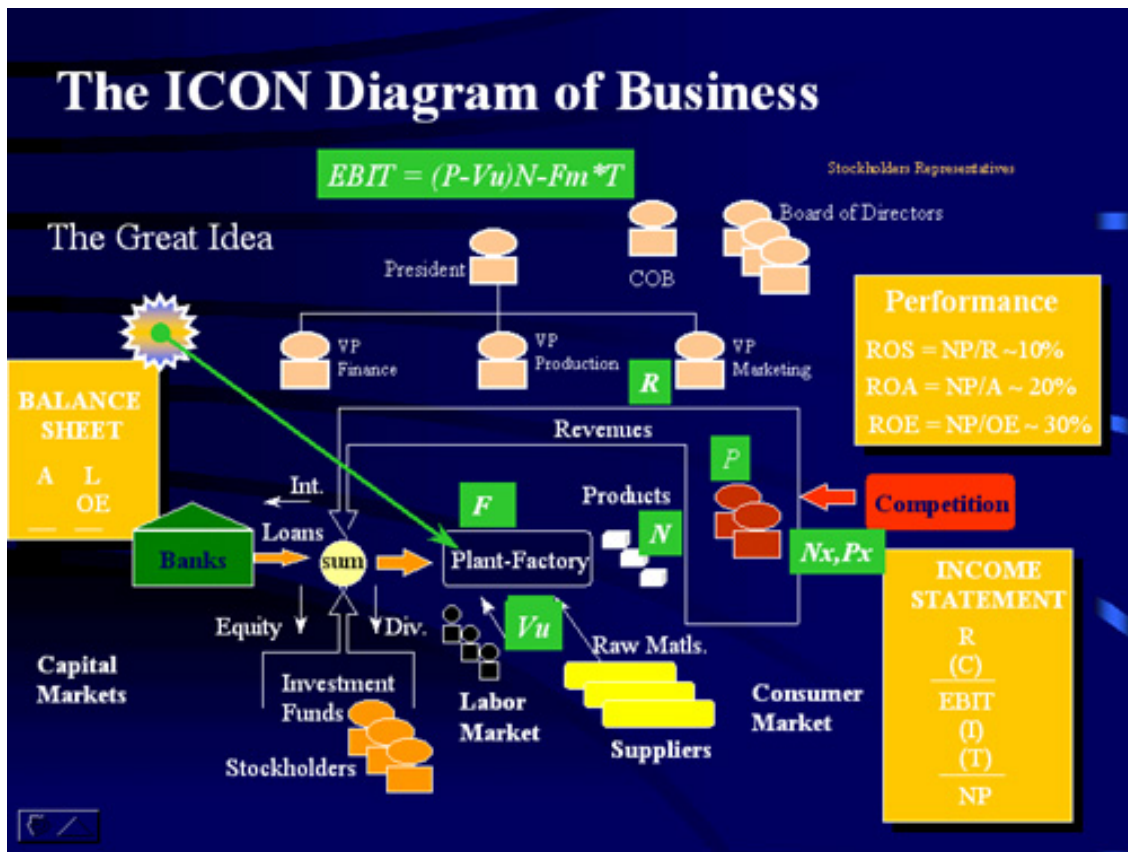
The products are transformed into revenue for the business by sales to the consuming markets. The revenues are **feedback** to the business for continued operations and future growth of the business.

Typically, the business is managed by a President and at least three VPs (Finance, Production/Operations and Marketing). The Board of Directors represents the stockholders.

The revenue must be sufficient to pay the interest demanded of the capital markets, the wages demanded of the labor market and the raw materials provided by the supplier markets and the cost of producing and selling the products and services and, of course, produce a surplus called the profit.

When the revenues exceed the total cost of producing and marketing the product, **all** or part of the profit is invested in the continued growth of the firm. Some or all of this reinvestment is made in R&D.

There are three markets in business, the capital market, the labor market and the consumer market. The supply in the consuming markets is provided by business and the demand by the household with price as the independent variable. The supply in the labor market is the household while the demand is business and wage is the independent variable. Finally, the supply in the capital markets are the banks and investors and the demand is business with interest &/or dividends being the independent variables.

## DO IT YOURSELF BUSINESS ANALYSIS

A business can also be modeled analytically. For JMSA the approach is to write the profit equation for each product or service offered by the business and then the sum the profits for all products and services. This is the math model of the whole business. One learns a great deal by following this simple **procedure,** as it is "business" in its simplest terms. It proceeds simply:

- Profit = Revenue - Cost

- Revenue = R = Price times the number of items sold = PN

- Cost = C = Direct cost of production/operations related to direct hands-on work on the product + the sum of the fixed monthly cost of doing business (over and above the cost of production and marketing) times the number of months the business is in operations = VN + FT .

Thus,

$$\text{Profit} = PN - VN - FT = (P-V)N - FT .$$

It is a law of microeconomics that as the price increases the sales decrease from a maximum value Nx, to zero at a maximum price of Px. Again, in simplest terms this behavioral law can be written

$$N = Nx(1-P/Px)^E,$$

 thus the "Profit Law" becomes

$$Pr = (P-V)(1-P/Px)Nx - FT,$$

here E (market elasticity) = 1 for simplicity. Also, in another form

$$Pr = (P-V)(Px-P)Nx/Px - FT$$

From the profit definition and the two forms of the quadratic profit laws we see that for business to make a positive profit, three conditions must be satisfied simultaneously:

1.  **P > V,**

2.  **P < Px,**

3.  **N > FT/(P-V).**

These relationships are remarkable. One might call these relationships the laws of business. If you break these laws, the business will fail. Said slightly differently; "A way to succeed in business is to avoid failure." **One can test a small or home business before it's launched. The test is to determine if the assumptions in the business satisfy these "laws of business".**

Let us **proceed** a bit further to find a number of amazing new insights:

(1) We see that when P = V the profit is -FT. The same it true for P = Px. So between P=V and P=Px, the profit must reach a maximum (PEAK) and that price is (we shall see) P = (Px+V)/2. Then we see that on substituting this price in the profit law, we find that that maximum profitability of the business is

$$Prx = .25NxPx(1-V/Px)^2 - FT.$$

**We can estimate the maximum profitability of the business before spending a dime getting into business. The question then becomes one of "Is it enough to make a living and grow the business?".**

(2) The profit definition shows us that at the bottom line, there are only four terms to manage in business: P,V, F, and N. Said slightly differently, all of the millions of considerations that a business manager is involved in really boil down to managing these four variables. The implications of this insight are that they focus management by asking the right cause-effect management questions whose answers can be quantified.

(3) When the price is double the variable cost (P=2V) of the product, the maximum profit, Prx, becomes a quadratic in V, and is maximized when the variable cost is on the order of V ~ Px/3.

(4) The "Profit Law" shows that the markets are characterized by only a few key terms, Nx, Px and E.

These relationships are the professional executives "rules of thumb" to understanding and managing a business. While these relationships are simplified for the student, they are the basics of business. This simple mathematical model is VALUABLE and important

because it is focused on the ESSENCE of business, scraping away the millions of details that it takes to run a business and shine a very bright light on the essential elements that make up the laws of business.

NOT TAUGHT AT HARVARD BUT VITAL INFORMATION: There is one vital lesson learned from consulting business that is NOT taught at HARVARD. The lesson is simply to pay your business taxes on time and be exactly right. The reason is that the penalties COMPOUND. They quickly rise to levels that can shut a small or home business down. I have witnessed small businesses that were thriving, die overnight due to underpaid taxes with the consequent penalty and compounded fees growing rapidly to levels beyond the reach of the business and its owners. I have seen tax burdens being as much as $50,000 in penalties and fees in a reputable music store that accumulated, unknown to the owners of the business, over a three year period. What amazed me is that the firm had no practical recourse against the tax preparation business, itself a small business. PAY YOUR TAXES. Neither the IRS nor the State nor the County nor the city will be merciful.

In closing this page, let me share with you what I believe to be the compelling argument for learning the Laws of Business. Many would agree that intuition is a powerful tool for guiding business success. Still others would say that analysis is a powerful tool for avoiding business failure. It is my view that **the** two together are better than either one alone. These relationships are further developed at the JMSA Business Caution and Warning System.