

How "Intelligent" Manufacturing Firms Build Social, Economic and Shareholder Value

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INTRODUCTION

The enthusiasm for so called "new economy" enterprises has scarcely waned in today's share markets, despite the experiences from the "dotcom bust" that welcomed in the new millennium. In 1993, Peter Drucker forecast that "the traditional factors of production - land, labor, and capital are becoming restraints rather than driving forces" and that "Knowledge is becoming the one critical factor of production". This basis for manufacture has continued to play out on the world's stock markets. Some manufacturing industry companies, the archetype for the past industrial age, have become unfashionable to share investors, who have moved their attention to "knowledge based" stocks.

So how are manufacturers responding? Rather than fighting against the onset of the knowledge based economy, some manufacturers are welcoming its progress by demonstrating their credentials in leveraging their knowledge and social capital. As well as maximising the returns to shareholders, they are also contributing benefits to the economy, environment and the community at large.

Many of the concepts that are instrumental in achieving this change have been explored through the Intelligent Manufacturing Systems (IMS) global research and development consortia, which claim membership organisations drawn from Japan, USA, Korea, Australia, Canada, the European Union, Norway and Switzerland. Specifically, this article draws on two sub-programs, the concept of "Holonc Manufacturing Systems" and "Globman21" (Global Manufacturing in the 21st Century) to illustrate how the manufacturing industry is currently adapting, and in some cases leading, in capturing the opportunities offered to companies and executives in the new knowledge based economy.

WHAT IS THE "NEW ECONOMY"?

Discussions on the "New Economy" involve acceptance of the following observations and activities since the 1970's.

The ratio of market valuations to tangible asset valuations have risen from 1 to between 4 to 5 times. i.e. less than 25% of a firm's market valuation can be attributed to its tangible assets. The gap is commonly attributed to the effect of "intangible assets".

- Shareholder returns have shifted from being largely dividend based, to one of capital gain i.e. a focus on capital growth returns over annuity returns.
- The large, vertically integrated firm is becoming the exception, rather than the rule, as global competition,

particularly in labour cost within supply chains, is forcing firms to concentrate on their core competencies and to "buy in" products or services that they can't internally provide competitively.

- The growth in alliance, joint venture and merger/acquisition activity is resulting in a market place which is increasingly networked and therefore highly interdependent.
- Product life cycles are becoming shorter, with customers now expecting faster and more innovative product offerings.

The above marketplace changes substantially define the evolution of the new economy. What part the manufacturing industry plays in the new economy will now be explored.

MANUFACTURING COMPANY SHARE MARKET VALUES RELATIVE TO TANGIBLE ASSET VALUES

Some traditional industrial stocks, heavily reliant on tangible physical assets, are now being replaced by low tangible asset stocks, at the top of stock market valuation lists. It is the author's view that the gap between market and tangible asset values is often attributed to the growth in importance of intangible assets. The analysis below, which compares the performance of S&P500 stocks from both the Information Technology and Telecommunications sectors on the one hand and the Materials and Industrials sectors on the other, indicates that many industrial companies are far from being left behind in the new economy stakes. From a point in the

S&P 500 Market to Book Ratios

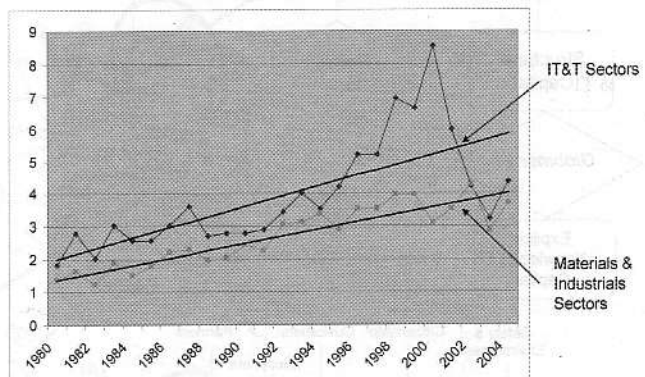


Figure 1 - S&P500 Ratio of Market to Book Values based on Assets

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late 1970's, where market valuations were equivalent to book valuations based on fixed assets, they are now on average up to four times these values. So the industrial sectors have managed to achieve impressive market value growth.

The results however, are not consistent across the manufacturing industry. The manufacturing sector as a whole is still largely challenged by how to prosper in the new economy. This is evidenced by the range of performances, as measured by average market to book value ratios. Leading new economy manufacturers like Dell and Cisco have sustained ratios of over eight times, whereas well known established names like Boeing, Alcoa and Ingersoll-Rand are struggling with ratios of around two times. In other words, leading new economy manufacturers have been able to generate over \$8 in market value for every \$1 in tangible assets held, compared with many of the traditional manufacturers struggling to generate over \$2 for every \$1 of tangible assets held.

Dell computers, has the manufacturing business model that most new economy manufacturers would aspire to. It allows customers to make custom orders on-line. It doesn't start the manufacturing process until the order is received. However, it has the ability to manufacture machines globally from standard components sourced from well qualified partners. This enables it to match, if not better, its competitors in both price and delivery performance. Dell is an archetype new economy manufacturer, who has been consistently rewarded with exceptional share price growth.

The common theme for new economy manufacturers is to attempt to own as little of the required physical capital as possible, while still maintaining the quality and delivery performance demanded by their customers. Managing the network of potential suppliers and partners becomes instrumental to achieving the required

integration, while minimizing the necessity to own all elements of the supply chain. Manufacturers like Dell computers, Nike and Cisco are well known examples of the new economy styles of manufacturing.

What has changed for manufacturers since the late 1970's is that market valuations are becoming increasingly dependent on how they leverage their intangibles in generating future value. Linear extrapolation of past financial performances is no longer a reliable predictive measure. The complication is that intangibles are not easily measured. A new way of managing for market value is required.

HOW IMS HELPS MANUFACTURERS LEVERAGE THEIR INTANGIBLES?

Swedish knowledge management pioneers Karl Erik Sveiby and Leif Edvinsson developed an advanced framework for thinking about intangibles and how they should be recognised in market valuations. When viewed with the advanced manufacturing concepts developed within the IMS research consortia, one can see how economic and social benefits can flow from manufacturers, with a focus on effective intangibles:

The above representation of intangible assets is an adaptation of those developed by Karl Erik Sveiby and Leif Edvinsson. Structural capital refers to a firm's assets which "do not go home at night with their employees". This includes physical assets like buildings, but also includes computer systems, specialized machinery, as well as softer assets like brands and trademarks. Human capital refers to the knowledge, competencies and experiences of individual employees. Knowledge capital is seen as the socially constructed result of integrating individual human capital and the organization's structural mechanisms for sustaining its capture and use. Knowledge capital is explicit e.g. business processes, standard operating procedures, computer data bases, and tacit i.e. knowledge that can't be codified, but can be sustained in expert networks or communities of practice.

Social capital has many definitions, but in this context refers to the network of relationships from which a firm can draw, for organizational advantage. In the new economy, relationships are critical. In the above framework, social capital mediates the benefits flowing from structural, human and knowledge capital into both economic and social benefits. Social capital benefits are typically divided into civic and corporate dimensions. In the business context, corporate social capital is about maximizing the value gained from relationships with customers, suppliers and partners. The argument is that high levels of corporate social capital are highly correlated with strong financial performance in the new economy.

Corporate social capital is however a relatively new phenomena. Social capital has historically been associated with civic or "public good" applications. Protecting the environment and the safety of staff, together with demonstrating good corporate citizenship are examples of "public good" activities that manufacturers regularly participate in. The difference in the new economy is that the rewards for such activities are now considered, by

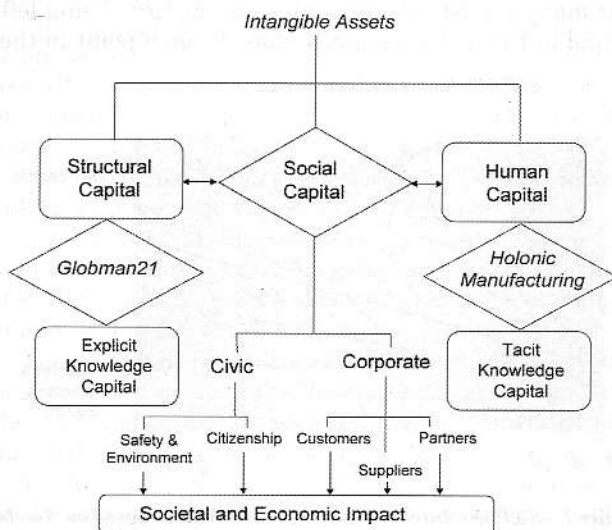


Figure 2 – Benefits from Intangible Assets and Intelligent Manufacturing Concepts

investors, to contribute to share-market performance. Some market analysts are now publishing rankings of firms based on so called triple bottom line reporting, which assesses social and environmental performance, along with financial performance.

The following analyses identify the role of IMS sub-programs, Holonic Manufacturing and Globman21, in contributing to manufacturing firms' abilities to leverage intangibles for shareholder returns as well as benefits to the environment and society at large.

HOLONIC MANUFACTURING

The term "Holon" was first coined by Hungarian author and philosopher Arthur Koestler, to describe a basic unit of organization in biological and social systems. Koestler observed that every identifiable unit of organization, such as a single cell in an animal or a family unit in society, comprises more basic units (plasma and nucleus, parents and siblings) while at the same time forming an interdependent part of a larger organization (muscle tissue or a community). i.e. a holon is an identifiable part of a system that has a unique identity, is entirely self supporting, yet is made up of sub-ordinate parts and in turn is part of a larger whole. The strength of a holonic organization is the ability to construct very complex systems that are both efficient in their use of resources and highly resilient to unforeseen disturbances.

Figure 3 provides a visualization of a typical interdependent network structure. The circles are nodes or actors. The connecting arrows identify directional relationships. Three common artifacts from network analysis are identified and described:

1. Central Actors: attract relationships with many other actors. This may be a prime manufacturer who is integrating a solution for a large client. In doing so, it attracts relationships with multiple suppliers looking to provide a component of the delivered solution.
2. Clusters or cliques: is a close, highly interdependent grouping of actors within the network. This may be a for-

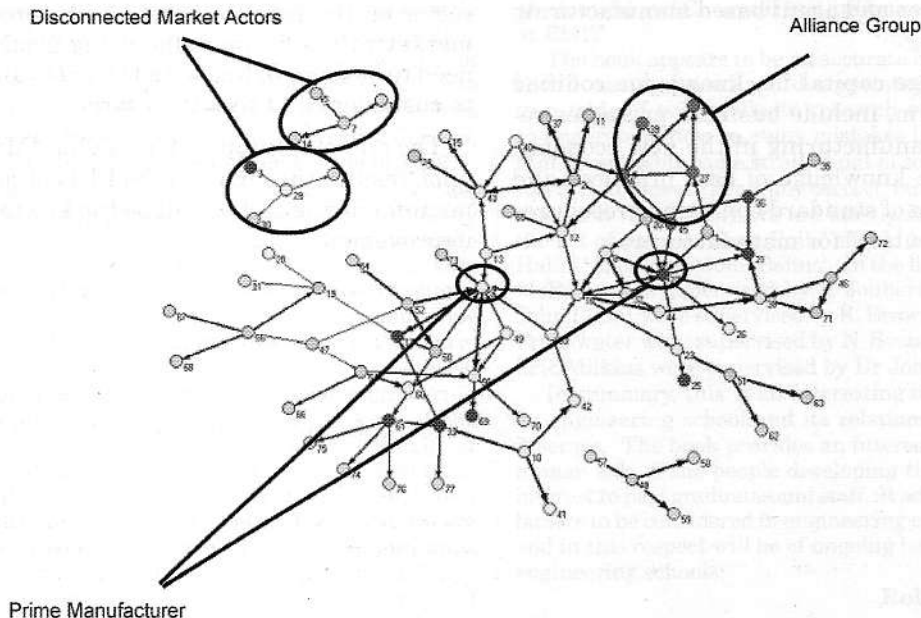
mal alliance network, established to pursue a particular part of the marketplace.

3. Isolates: as networks form and adapt there will invariably be at some point in time, disconnected parts, which will either connect to the core network or disappear completely. This could represent start-up firms bringing a new innovation to the market place, or at the other extreme, a firm that has become disconnected from the mainstream needs of the marketplace.

Manufacturing firms need to understand what roles they may be playing in the networked marketplace. For example, a prime manufacturer must maintain the lead relationship with the customer. It must also be able to draw "best of breed" solution components from its supplier network, to ensure that the customer receives the best possible solution to their needs. Component suppliers need to ensure that they can maintain relationships with multiple prime manufacturers, to maximize their opportunity base. Complex customer requirements may need several manufacturers to undertake a joint venturing approach to achieve a competitive solution. Finally, if a firm is isolated from the core network, it needs to determine whether it is offering a market leading solution that will eventually attract potential partners and/or customers from the core network, or whether its solutions are no longer relevant to the market place.

Amazon.com was clearly an isolate when it launched its internet book shop business model in the mid 1990s. Its ride with the dotcom bubble is well known, as its market valuations climbed above established manufacturing giants, before it had even earned its first dollar in profit. As a post dotcom survivor, Amazon is learning to balance what it needs to "own", and what it can safely source externally. It is now well and truly integrated into mainstream distribution networks. The lesson is that there are limits to how "light" a manufacturer or distributor can be in the ownership of physical assets

Figure 3 - The Networked Marketplace



Holonic manufacturing system concepts will assist manufacturers by helping them visualize where they might fit into the networked market place and what opportunities they may have in leveraging their core capabilities within the network. Holonic concepts support relationship development within a networked market environment i.e. corporate social capital. At the firm level, individual tacit knowledge and skills are in fact holons within the firm's organizational structure. The firm's human capital and tacit knowledge capital, will help define a firm's competitiveness, as predicted by Drucker.

GLOBMAN21

This global manufacturing in the 21st century program is concerned with the development of business processes and technologies required to operate globally distributed enterprises in the environment, and under conditions anticipated for the future i.e. the new economy. This research program addresses topics as broad as information access and control, product modeling, data communications infrastructure, networking with suppliers and customers and agent systems for monitoring distributed operations and supply chains. Project outcomes are stated as:

- An increased understanding of the key business processes in manufacturing.
- New management tools to operate in a world of global virtual enterprises.
- New technologies and new applications in fields such as modeling, simulation, control, artificial intelligence and human organization issues.
- Architecture for more efficient, high quality production in all domains of manufacture.

While holonics is closely aligned with the intangible concepts of social, human and tacit knowledge capital, Globman21 is closely aligned with the concepts of structural capital and the development of explicit knowledge capital. The structural capital being developed by Globman21 includes distributed data communications infrastructures, distributed data bases, information access and control mechanisms, simulation tools, distributed architectures and agent based manufacturing monitoring systems.

Explicit knowledge capital i.e. knowledge codified in informational form, include business processes required for global manufacturing in the new economy. Making explicit the knowledge of best practices and processes in the form of standard operating procedures is now "bread and butter" for manufacturers .

Collectively, the Holonics Manufacturing Systems and Globman21 programs contribute strongly by helping manufacturing firms better understand how to leverage their intangibles, in the form of structural, social and knowledge capital. Systematizing knowledge based processes has been a foundation for the TQM and Six Sigma programs that manufacturers have shown clear leadership in. More challenging is the use of a manufacturing firm's knowledge and social capital for innovation i.e. exploring for new opportunities and growth prospects required to thrive in the new economy.

SUMMARY

The advanced IMS concepts of holonics and global manufacturing are preparing manufacturers to prosper in the new economy through their impact on valuable intangibles and in particular, social capital. Globman21 has developed designs for the infrastructure required to successfully operate in a distributed and networked market economy. Communications infrastructure, simulation tools and explicit new globally attuned business processes form part of the new economy infrastructure for manufacturers.

Holonics provides the underlying organizational model, which can map manufacturing activities from machine control, the tacit knowledge of individuals, through logistic organization and eventually the networked marketplace of the new economy. Holonic's biological and social heritage is well suited to supporting manufacturers to increase their levels of social capital. The challenge now is to convert those manufacturers whose heritage and culture are heavily in-grained in industrial age thinking, to adopt the IMS and intangible asset concepts required to thrive in the new economy.

The proportion of consumer spending on services is considered to now outstrip that on manufactured goods, as income levels and living standards increase in developed countries . These societal changes will force structural changes in the manufacturing sector. Government and manufacturing industry professional groups will need to play a key role in re-educating the sector on the new skills required to re-establish real market values for manufacturing firms. These values need to be more in line with the true value they deliver to customers and society at large.

The on-going support for moving IMS concepts and pilot results through to broad based adoption by the manufacturing sector, will be the key to achieving this improvement.