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A Case for CIM

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Introduction

A whole new philosophy of business must be adopted by companies considering Computer Integrated Manufacturing. They must broaden their thinking to strategic dimensions. And they must be ready for bold action.

Some manufacturers already know that. They've felt the sharp sting of international competition. They've discovered their competitors are on the next continent, as well as in the next town.

Shrinking American Trade

American manufacturers have probably felt more pain than any other group. *The Economist* recently reported that America's world trade shrank from 21 percent to 14 percent in the past quarter century. In that time, the U.S. trade balance tumbled from a healthy $5 billion dollar surplus...to a $150 billion dollar deficit.

And it gets worse. In the past five years alone, America's trade balance in manufactured goods fell from an $11 billion dollar surplus to a $32 billion dollar deficit. America's manufacturing export volume tumbled 32% ...and every billion dollars of lost exports cost an estimated 25,000 American jobs.

That's not to say that manufacturing isn't big business anymore. The wealth is there, even if the jobs aren't. Manufacturing's contribution to the Gross National Product has remained a constant 20% to 25% since 1947.

But U.S. manufacturers increasingly recognize that today, the only way they can meet global competitors head on -- and win...is with CIM.

So what's causing all of this change?

The New Global Economy

Peter Drucker recently observed that economic dynamics have shifted us from a national economy to a global one. Only a few decades ago the world's economies were based on natural resources. A nation's climate, waterways and minerals created the competitive advantages which defined its manufacturing specializations. Then, in the 1960s, we began to see the emergence of a created competitive advantage: lower labor

costs. Developing countries with large labor pools attracted manufacturers from more industrialized countries who sought the advantage of lower labor costs. These emerging nations created their own manufacturing specializations. They gradually built capital and developed infrastructures of transportation and communication. Today they put pressure on their more advanced counterparts. Thus, the international playing field has been leveled considerably.

Natural resources have decoupled from national boundaries, direct labor is decoupling from production, and capital and technology have combined to form a new driving economic force. Today, any country can buy raw materials such as oil and copper on the world market -- and they'll pay approximately the same price as anyone else. So, natural resources are no longer a differentiator. Neither are the wages of a nation's labor force, because direct labor is an insignificant cost factor in advanced manufacturing.

Computer Integrated Manufacturing

These changes are forcing advanced nations to compete with three new resources: capital, technology and know-how -- the kind of technical know-how found only in large pools of educated professionals. Properly blended, this capital, technology and people forms a new competitive advantage and a new natural resource: Computer Integrated Manufacturing, CIM.

Evolutionary -- Not Revolutionary

Some view CIM with fear, seeing it as an unnatural, disruptive force. But it's far from that. CIM isn't revolutionary -- CIM is evolutionary. It's the most recent development in the quest to produce better quality products at lower cost, with less human involvement. That quest began two hundred years ago, with the industrial revolution -- an upheaval that thrust farm workers into city factories, and changed a barter-based economy into a currency-based one. Mechanization followed, harnessing steam generation to power machines. Next, electrification gave birth to modern manufacturing. Then came computer control, making automation possible. Computer Integrated Manufacturing is the next logical step in this evolution -- a step that requires no great leap of faith. CIM is an advanced business philosophy that unifies a company's administration, engineering and manufacturing.

Strategy for Survival

To manufacturers inundated by the tides of global competition, CIM is an attractive strategy for survival, growth and prosperity. With CIM, they can achieve the levels of

quality, cost and service they need to become competent global competitors.

Financial Justification

Unfortunately, once a manufacturer concludes that CIM is the path to survival, he faces the wilderness of financial justification. Even though manufacturing and accounting experts have contributed much to knowledge and theories about CIM justification, the process remains intimidating. Traditional accounting methods which have served industry for decades lose relevance when applied to manufacturing systems that are flexible and reusable. Some of CIM's most valued benefits are just not quantifiable by traditional accounting methods, nor are there proven new ways of evaluating them. It's easy to see the problems one encounters when trying to justify CIM to a board of directors which has always dealt with traditional accounting methods and is unfamiliar with CIM's advantages.

At this point, the justification of CIM remains as much a strategic issue as a financial one. And for many manufacturers who are getting their first glimpse of global competition, the strategic issue can be interpreted as: "Do I want to stay in this business or don't I?"

Before going further, let's define CIM.

A Definition of CIM

Computer Integrated Manufacturing integrates the "factors of production" to organize every event that occurs in a manufacturing business, from receipt of a customer's order to delivery of the product. The ultimate goal is to integrate the production processes, the material, sales marketing, purchasing, administration and engineering information flows into a single closed-loop controlled system.

CIM is a whole new philosophy of business. A whole new way of thinking that requires new strategies, new management techniques and new manufacturing dynamics. True CIM means the complete integration of a company's office, engineering and manufacturing.

Engineering

In many firms, engineering is already experiencing tremendous productivity gains through computer aided design (CAD) and computer aided engineering (CAE). A similar process has begun in the office, where more than two million desk top computers have stopped the slide of productivity - - but it's not overall productivity...it's individual productivity,

because generally these work stations aren't integrated with larger data bases. Manufacturing is just now turning to a variety of computerized controls. And in these early stages, that's creating islands of automation on the factory floor. The world class company of the future will integrate all three areas...the office, engineering and manufacturing... into a closed loop system for the entire production cycle. This closed loop CIM system can provide quantum improvements in...

Human Productivity

Human Productivity -- A manufacturer's ultimate goal should be to make every action in his facility add value to the product. But look at any company and you'll see human beings at every level performing tasks which don't add value -- tasks which are unproductive. For instance, it makes no sense for people to read instruments, write down the readings, then keyboard them into a computer -- when that can be done on an automated basis. Computerizing that work, and integrating it into a system, can result in higher productivity and lower cost. It frees workers for more productive tasks and shifts management's emphasis from supervising people to supervising machines.

Capital Resource Productivity

CIM can improve Capital Resource Productivity. CIM makes better use of capital resources, helping us use fewer "things" -- fewer machines, lower inventory and less space -- to achieve greater output at lower cost.

Quality

CIM can improve Quality. Quality is today's competitive edge, and the customer sets the standard for it. To paraphrase author John Guaspari, the customer can't define quality, he just knows it when he sees it. You'll know it when he sees it too, because quality will reward you with higher profits and larger market shares. CIM helps you afford external quality -- customer satisfaction -- at a lower cost, because it gives you higher internal quality -- the elimination of waste -- from the design, engineering and production cycle.

Economies of Scope

CIM offers Economies of Scale through Economies of Scope. No doubt about it, a CIM investment is a major one. Clearly, you need enough units flowing through your system to justify the investment. But how can you make money on production runs as small as a lot size of one? Unlike traditional manufacturing, which is based on large volumes of identical products, CIM produces many products with many product variations. In a minute's time, a CIM assembly line can serve a multitude of needs -- not just one. It can produce a lot size of

one, or a lot size of thousands -- one after the other. It offers greater volume through greater variety, letting you spread your investment over many different products, with the total number of units creating the economy of scale for profitability.

Rapid Response

CIM offers a Rapid Response to the Marketplace. CIM flexibility gives you the ability to be first into the marketplace....to gain significant market share before competitors can catch up. It lets you respond rapidly to a changing marketplace with greater customer service -- with improved product development cycles, the flexibility to meet even the smallest demands, and the shortest possible delivery time.

If you're the best in the world at these things, you'll be a winner. You'll have the highest human productivity, the lowest allocation of capital resources per unit, the lowest waste, the best quality and the fastest response to changing markets. All of that will make you the low cost producer. And if your marketing people do their job right, you'll be the market leader too. Unfortunately, there's not a company today that's doing all these things.

Considering the benefits, a decision to invest in computer integrated manufacturing should be an easy one. The necessary computers and communications technologies are available and proven in operation. In spite of this, many manufacturers don't feel threatened enough to take CIM seriously. They've seen what's happened in the automotive, steel and consumer electronics industries, but they don't see themselves in a race for survival.

Barriers to CIM

Let's look at the major barriers to Computer Integrated Manufacturing.

Offsetting America's lead in advanced technologies is the limited vision of many executives. On one hand is the "successful" CEO who sees little need to tinker with what's worked in the past -- even though new world competitors are nibbling at his market share. At the other end of the spectrum is the shortsighted CEO whose vision extends only as far as the next quarterly report. He's as cost-conscious as they come -- just don't rock the status quo by suggesting any major changes in the way his firm designs and produces his product.

But the problem doesn't just rest with the CEO. Too often manufacturing management has no idea of the competitive situation. No one ever asked them to examine their cost drivers. They're too busy getting product out the door anyway. Survival? That's someone else's responsibility, not theirs!

Management

Management educated in the 1950s and '60s presents another level of complexity. Most of these people were schooled long before today's technologies emerged. Too few are computer literate or have sufficient respect for the power of this basic tool. And that problem is really deeper than the management level. In one major U.S. company with 3,500 electrical engineers, only 500 understand programmable controllers. 3,000 have never been trained on them, even though the PLC has been a part of American industry since 1970.

Management at all levels has been trained to propose incremental measures rather than those that offer quantum improvements. That's because smaller projects usually only require the approval of plant managers, while larger ones have to work their way up -- sometimes all the way up to the board of directors. So we've been inching our way to survival and prosperity, scaling projects to levels of authority. Unfortunately, we've fallen behind the rest of the world, and now, we have to race ahead to catch up. But we can't race ahead with incremental steps. We have to leap forward with quantum improvements.

Financial Justification

Industry's accounting tools pose serious problems too. Traditionally, Return on Investment and Internal Rate of Return have been used to evaluate capital projects. While these methods work well to evaluate the financial implications of an individual machine, they're not appropriate for analyzing all the benefits of a CIM installation.

That's the problem. Traditional financial justification procedures based on Internal Rates of Return, or short payback periods, are perhaps the greatest single barrier to adoption of new manufacturing technologies by U.S. industries.

Inadequacies of Current Investment Models

Let's examine the inadequacies of the current investment model.

Traditional cost models just weren't designed for today's computer integrated manufacturing. A classic case in the metal working industry is the use of full absorption accounting, where direct labor is generally used to absorb overhead charges. But today, direct labor accounts for less than 10% of the sales value of a product, and CIM can lower that percentage even further. So obviously, measuring costs based on labor's absorption of overhead is questionable when so little direct labor is involved.

What is needed, is a new accounting methodology -- one which distinguishes between those items that add value, and those that only add cost. A second challenge is to measure those benefits that are difficult to quantify.

Mediocrity Mode

Traditional accounting models like Return on Investment and Internal Rate of Return focus on the time value of money, and give little thought to the strategic opportunities and threats that technological advances present. It's automatically assumed that money on hand is worth more than money promised in the future. A cost deferred is preferable to a cost incurred. This kind of thinking puts many companies into a "Mediocrity Mode."

Using these models, an investment is made in hopes of realizing significant return in the form of cash flow in subsequent years. The projected annual returns are discounted to reflect the time value of money. At the end of the justification period -- in this example, five years -- the investment has some residual value. Traditionally, an investment is justifiable if the sum of the discounted cash flows plus the residual value exceeds the original investment. Too often, this process encourages accountants to focus on the tactics of discount rates and residual values, instead of taking a broader, more strategic view.

Lets take a critical look at these accounting models and examine their shortcomings.

Tactical, Not Strategic

They're tactical instead of strategic. These models are short-term, project-oriented tactical evaluation tools -- not strategic planning tools. To survive, grow and prosper, we have to

adopt new business strategies for manufacturing companies. But with current financial models, we'll never get there. Short term, incremental measures rarely lead to quantum advances.

Short Payoff Periods

They require short payoff periods, frequently three to five years. This, despite the fact that CIM is designed for longer life. Many CIM investments won't pay for themselves within that time frame. They're not supposed to. They're long-term strategic measures. In fact, most CIM systems will probably outlive the products they're designed to produce. But a CIM system's reusability will let it shift easily to other production. In other words, A CIM investment won't reach terminal value until long after the traditionally accepted three to five year periods -- and even that value may equal or exceed that of the original investment.

Inappropriate Costs of Capital

They use inappropriate costs of capital. Discount rates for traditional models are usually based on rates for five-year treasury notes, thirty-year bond rates, the Prime rate or the LIBOR rate. But these are all inappropriate for long term planning -- they're merely snapshots in a moment of time. Just five years ago, interest rates on 30-year bonds were two to three times higher than today's rates. It's easy to imagine how many long-term projects those rates killed or postponed. For CIM planning, what you need is a blended, long-term, composite view of rates, based on historical and projected trends.

Low Risk Investments

They favor low-risk cash-producing investments. But many projects of strategic importance won't produce positive cash for five years or more. Unfortunately, these models make no provision for today's cash user becoming tomorrow's cash provider.

Ignore Intangibles

They ignore intangibles which could enhance revenues. How will more-consistent quality improve your market share? How will the flexibility to make product changes enhance your competitive situation? How will reduced economic order quantities and shorter delivery times affect customer satisfaction? These intangibles can have real value in today's marketplace. Unfortunately, they have no value in today's models. The challenge is for management to see these intangibles as revenue enhancers and assign them value. This will require subjective judgement, but management is well skilled at that. Many of its decisions are based on experience and intuition as well as fact.

After examining the shortcomings of these traditional models, it's clear that management must rethink its guidelines for justification procedures. Of even greater importance is management's responsiblility to develop a strategic approach to CIM.

CIM - A New Philosophy of Business

CIM is a major philosophical change for all of us. Until recently, we considered the office, engineering and manufacturing separately. Even today, too many people think of CIM in terms of the factory floor alone. But for CIM to succeed, we must integrate all three business environments -- office, engineering and manufacturing -- welding them into a single smooth-running machine. To achieve that, work produced in all areas and at all levels of your company must be done as efficiently as possible, with the highest quality, at the lowest possible cost. CIM must involve everything and everyone, from the chairman of the board to the custodian. In other words, CIM is a whole new way of doing business. It requires new management techniques, new strategies, and new organizational structures to accommodate new manufacturing dynamics.

Longer-Term Investments

CIM also requires new ways of looking at investments. For years, management made long-term financial projections based on the assumption that things would go on as they always had. This worked well from World War II through the late 70s. But it's a different world now. It's no longer safe to measure capital expenditure investments against a status quo alternative of not making the investment. Who today feels comfortable assuming a continuation of current market share, current selling price, current costs? Instead, one should consider the prospects of declining cash flows, shrinking market share, and smaller profit margins. The status quo means little to hungry worldwide competitors.

No doubt about it, successful investments must yield returns greater than the cost of the capital invested. But enlightened management must evaluate CIM investments in terms of long-term objectives. In other words, management's viewpoint must be changed: it should start with a strategy, not an investment.

Unfortunately, the IRR and NPV models are project or tactically-oriented -- not strategically-oriented. As such, they're not relevant to today's struggle for survival. To survive, manufacturers have to look beyond tactics. They

can't move from tactic to tactic until a strategy emerges. That's why CIM automation architecture has to drive CIM accounting architecture. Manufacturers must take strategic long-term views of their future and where they want to be. They must initiate strategic planning processes, which will lead to new business strategies throughout their companies.

Many firms have fought their way through the justification barriers and implemented CIM with surprising results. Recent studies by Frost & Sullivan and the Yankee Group show that improvements of 50 to over 75% are the norm for those who dare to implement computer integrated manufacturing.

Allen-Bradley's CIM Experience

Allen-Bradley has been involved in numerous CIM projects throughout the world, but the one we know best is our very own: the World Contactor assembly facility in Milwaukee. Some years ago, we saw that the merging international standards for motor controls would eventually threaten one of our core businesses. To remain competitive, we not only needed a new product, we needed one that could be sold profitably anywhere in the world. Off-shore sourcing was examined and quickly discarded. The engineering skills were already in place in Milwaukee, and they were unmatched anywhere in the world.

A New Product & A New Process

The solution was a new product, and a new production line, developed by design and production engineers working as a team. Other experts were assigned to the project from Quality Assurance, MIS, Marketing and Purchasing. The objectives were to develop a world-class product and a production facility with the following goals:

High volume - 600/hr.
125 product variations in lot sizes of one.
Products built-to-order within 24 hours.
Located within existed plant.
Competitively insignificant labor costs.

World Contactor Facility

So, we built our World Contactor Facility as part of a strategic plan to capture a higher share of the world market for electrical contactors. The result? We met all our objectives. Today we have a totally integrated CIM facility whose relative cost per unit is 60% that of machine assisted labor. And this system has already demonstrated a flexibility to respond to market demands. Instead of the original 125 product variations, it now offers 600 variations...in lot sizes as small as

one. And relative return on assets is five times what it would have been with traditional manufacturing.

Today, we're producing consistently higher quality contactors -- with a rejection rate of just 20 units per million -- at a lower per unit cost than anyone else in the world. And that's not all. We're the global market leader. And with this CIM facility, we intend to stay that way.

CIM Do's and Don'ts

So how do you implement CIM? What are the rules? Based on our global experience with Computer Integrated Manufacturing, here are some do's and don'ts:

• **Don't start the trip without a roadmap.** You must have long-term objectives and these should be supported by long-range plans.

• **Remember, what's tailor-made fits best.** For new products, design the product and the process simultaneously. Don't make one a slave to the other.

• **Set your sights high.** Make zero defects and a lot size of one your goal. If survival is your target, you're aiming too low. Shoot for profit. Thrive, don't survive. Raise your sights and make quality a competitive weapon. Seek the flexibility to give your facility a longer life than the product it's producing. And remember, CIM's economies of scope make economies of scale possible. If you can produce profitably to a lot size of one, imagine how profitable you'll be on high volume runs.

• **Make your system great, then automate.** Automating a system that's out of whack can only give you automated confusion. Bad manufacturing practices and unstable processes shouldn't be automated. After all, you wouldn't put your company's general ledger system under computer control if you couldn't balance it by hand.

• **Only automate things that add value.** In existing plants, separate your costs into those that add value and those that add cost. Then, get rid of the latter and automate the former.

• **Don't focus on reducing direct labor.** Direct labor accounts for less than 10% of the sales dollar for most products produced in the United States. You can achieve

Do's and Don'ts (continued)

bigger savings by reducing indirect labor, trimming inventory and lowering the cost of quality.

• **Plan from the top down. Implement from the bottom up.** Draw up a blueprint then start building a solid foundation. Don't buy hardware until you have a blueprint. Plan first and implement second. Make sure you have the right building blocks in place -- things you can ultimately integrate.

• **Eat the elephant one bite at a time.** For existing plants, automating step by step is fine. Don't try to do more than you're prepared to. But remember, there's a difference between step-by-step automation and piecemeal automation. Everyone must follow the same plan.

• **Don't implement without trained people.** CIM requires an innovative and highly productive organization. Each employee is a critical link in the system. These individuals must be properly trained, motivated and rewarded.

Summary

The global economy is here. The need for CIM is clear. In a short span of time, resources have decoupled from national boundaries, labor is decoupling from production, capital has become the driving force of trade. Today, competition comes from all directions. Markets demand faster response. And windows of opportunity slam shut before many realize they've opened.

Yesterday's ways of doing business are passè. Yesterday's investment models are irrelevant. We can't profit by them -- we can't even survive by them. Deferring a CIM investment until returns meet accepted norms could be a decision to drop out as a principal player -- or worse.

It's a brave new world, and it requires bravery, not fear. You can survive on fear. But you can't very well thrive on it. CIM offers you a way to thrive. A way to fuse all the elements of a manufacturing company into a single smooth-running machine, making you the leader in quality, cost and service. Getting to that point will take some time, because CIM requires a company to change the way it thinks...and works. But that's OK. Because you don't have to buy the whole store at once. You can think big and start small. And that's the point. It's time. Time to start drawing up a long-term CIM strategy. Time to start down the road...to survival, growth and prosperity.