

QIP Strategy Presentation

c. March, 1988[©]

by

Arthur M. Schneiderman

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By the end of 1987, we had a QIP deployment plan, a set of strategically derived performance metrics and a way to manage them: the annual planning process and scorecard system. In early 1988, I gave this presentation as part of our worldwide rollout of the 1988-1992 five-year strategic plan. Because of its importance as the roadmap Analog would be using for the next five years, each of the key presenters (Ray, Jerry, the CFO, the VPs of worldwide sales, technology, HR, and QPI) prepared a written speech which was reviewed and critiqued in advance by the other speakers. This speech, and the associated slides, captures, at a high level, where we were in early 1988 and where we expected to get to on our TQM journey.

QIP Strategy Presentation c. March, 1988

Arthur M. Schneiderman

Good afternoon

This morning Ray¹ set the stage, and Jerry² filled in many of the details of what I believe is a credible and achievable plan to grow us to a billion dollar company over the next five years. I've reached this conclusion not only as a result of my participation in our strategic planning process, but also based on a decade of experience in strategy development with a large number of other companies.

Given the realistic potential that has been identified, you might ask, "can't we achieve it with just more of the same?" I think that there is growing evidence and an emerging consensus that the answer is yes, ... and no. We need to continue to do those things that have made us the successful company that we are today; but we must also adapt to the changing needs of our customers and the growing aggressiveness of our worldwide competition.

One of the principal tools that we will be using to implement our strategy is the quality improvement process or QIP.

In 1985, Ray introduced QIP to the Analog Devices community. QIP is now spreading rapidly throughout Analog and is in wide use as a tool for critical problem identification and solution. At last count, there were nearly 150 QIP teams with over 650 participants worldwide. This diffusion of QIP activity throughout the company has been driven by the corporate QIP Council. They have developed a QIP strategy, which will provide an umbrella under which we will implement our five-year strategic plan.

Today, I would like to share with you several of the key elements of our corporate QIP strategy. I will describe to you what we have identified as the most important things that we need to do in order to advance our Corporate Objective, and how we will go about ensuring that every member of our community understands how they can contribute to that effort. Next I will describe a comprehensive set of metrics that we are currently developing. These metrics will help us to set specific numerical goals and track progress toward them. Finally, I will outline a QIP training program which will be implemented during this year and which will have the goal of assuring a corporate wide understanding of QIP, as well providing training in the QIP methodology itself.

The starting point for our QIP strategy is the [Analog Devices Corporate Objective](#), a short, simple document that can be found in every HR department. Although it might easily go unnoticed, it contains a concise statement of what we are as a company, our mission, and our overall goals. In QIP, one of the first questions we ask is "who's my customer?" The Corporate

¹ Ray Stata, then Chairman, CEO and President, now Chairman.

² Jerry Fishman, then Group Vice President, Components, now CEO and President.

Objective answers this question by identifying not one, but five corporate customers or constituents. A more popular word that's coming into vogue now a days is the term corporate "stakeholders." Whereas many companies believe that they exist exclusively for the benefit of their stockholders, Ray has forged a consensus which broadens our "QIP customers" to also include our employees, external customers, suppliers and communities. It goes on to describe, in broad terms, our objectives for meeting the needs of each of these constituents.

For each of our corporate QIP customers, we must answer a number of questions in order to identify our greatest opportunities for improvement. What are their needs? How do they rate us in meeting those needs? What are our rewards? What are the external levers, the vital few means for advancing our rating and increasing those rewards.

Having taken this external perspective, having listened to the voice of the customer, we need to turn inward and identify those internal levers that will most efficiently drive the external ones. Metrics represent a comprehensive set of primary and secondary or surrogate measurements, which unambiguously tell us whether we are improving. Along with metrics go goals that represent a realistic but aggressive timetable for these improvements.

Slide 2

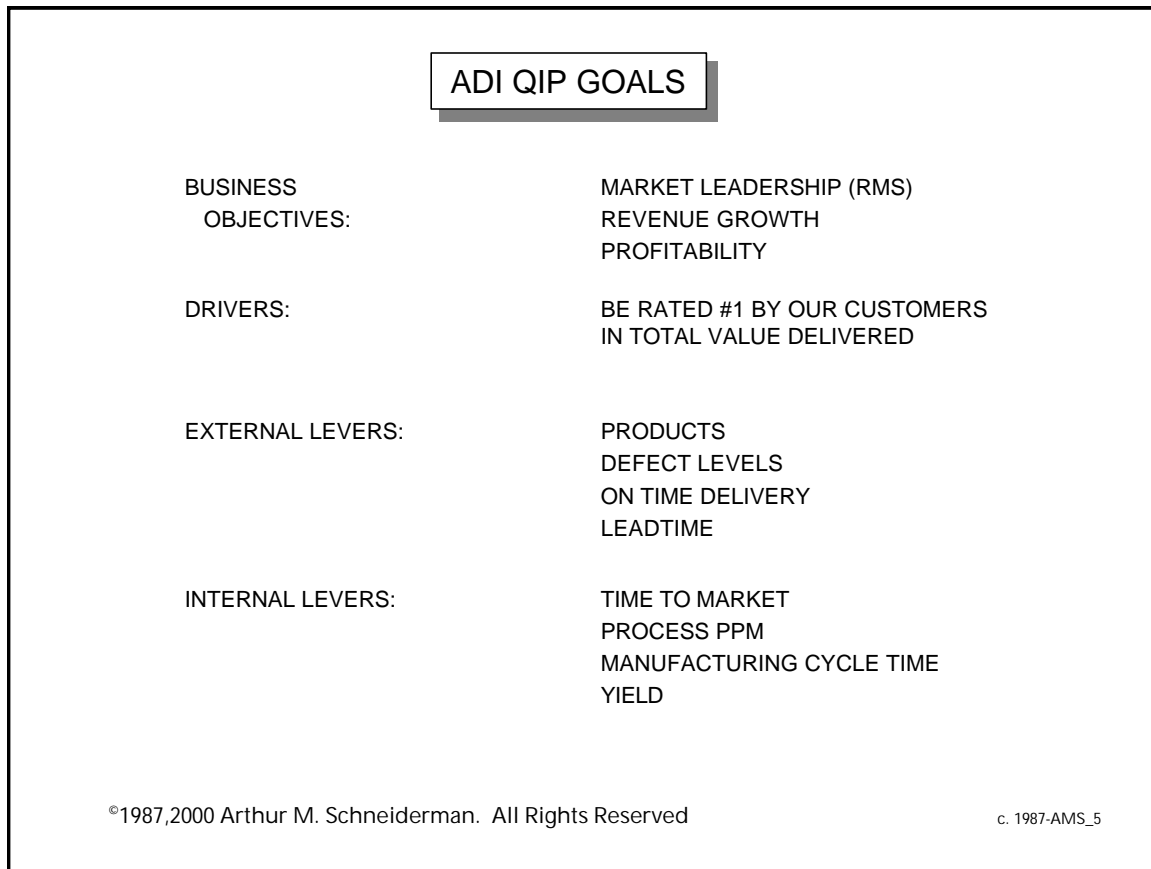
ADI CORPORATE QIP COUNCIL		
MEMBERS:	Jerry Fishman	Executive VP
	Kozo Imai	VP, Japanese Operations
	Larry LaFranchi	Operations Controller
	Bill Manning	Division GM
	Art Schneiderman, Chairman	VP, Quality/Productivity Improvement
	Ray Stata	Chairman of the Board and President
	Graham Sterling	VP
	Goodloe Suttler	Division GM
	Arnie Kanarick	VP, Human Resources
	Tom Urwin	VP, European Operations
CHARTER:	QIP Organization	
	QIP Goals Deployment	▣▣▣▣ priorities
	Training	▣▣▣▣ Juran
	Monitoring	▣▣▣▣ metrics
	Incenting/Rewarding	

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Before I review with you the results of asking these questions, let me take a moment to show you the names of the members of the corporate QIP council, the group within ADI that has been chartered to find these answers.

This group addressed these questions to each of our corporate constituents and synthesized their answers into a single set of ADI QIP goals.

Slide 3



The common theme that drives all of our needs is the achievement of our overall business objectives. This is the ball that we must always keep our eyes on. Market leadership is measured by our relative market share. Our aggregate relative market share is a healthy 2.5 and is the principal basis for our historic profitability.

Traditional strategic planning classifies businesses along two dimensions: market growth rate and relative market share. This construct has proven to be useful because business life is so different in each of the resulting quadrants. One of them is hi growth, hi RMS, and that's the place we've chosen to be as a company. It's easy to take that decision for granted but it is a conscious one arrived at by understanding the cultural aspects of life in each of the quadrants. That's why continued high revenue growth along with high RMS are our over-riding business objectives. Normative strategic patterns assure us the potential for achieving high profitability if we achieve the other two independent objectives. That potential profitability can easily be lost, however, through the many forms of waste. QIP provides a powerful tool for uncovering and eliminating organizational waste with the resulting achievement of our profit potential.

In the long term, there is only one-way to achieve our business objectives: to be rated #1 by our customers in total value delivered. Total value delivered includes not only price paid, but also a growing number of other considerations -- but more on that later.

How do we know how we are rated by our customers? Very simply, they tell us. In past years this has been an informal qualitative process, mostly subjective, often highly distorted by perceptions that are at variance with reality. Today more and more of our customers are installing formal quantitative vendor rating systems. Today, 35% of our revenue base is from customers with formal rating systems. We expect this number to rise to nearly 90% by 1992.

What are the elements of these vendor-rating systems? Many of us remember the days when they were performance, performance, performance. That's changing dramatically. Today, our customers are telling us that their three most critical needs are on-time delivery, quality, and price, in that order. They not only tell us that, but they measure their vendors' performance and publish the results.

With the proliferation of JIT lines, our customers are demanding shorter and shorter lead-times.

Other less quantifiable needs are emerging; new products, jointly developed through early involvement; automated systems for order entry and tracking or EDI (Electronic Data Interchange) as it is commonly called; responsiveness and support; administration.... you may wonder how that one makes the list. Well it turns out that clerical errors: things like invoice errors, wrong parts, and wrong part counts very quickly rise to the top of the list of costs that our customers incur as a result of our not doing it right the first time.... next, they want management involvement and finally innovation, not only in our products but in the way we go about satisfying all of their needs.

Mel has described to you our new customer partnership program, which is our response to their expressed need for establishing relationships with their vendors.

Before we move on, I'd like to make two further points. Vendor qualification is a system used by our customers to dramatically reduce their number of suppliers. It is not unusual for a company to go from literally thousands of suppliers down to a hundred or so through a vendor reduction program. Becoming a qualified vendor to all of our key accounts will be critical to the achievement of our strategy. We will only do this by meeting these evolving customer needs and doing it better than our competition. By the way, we recently made the cut at Tektronix when they went from 105 to 16 new

component suppliers. We were not so fortunate at Fluke so there's still lots of work to be done.

As you know, one of our major strategic thrusts is into the consumer market, a place where vendor qualification programs are much more common than in the military or industrial markets. We will not win a single design in at a company like Apple computer until we become one of their qualified vendors, and that will be a major challenge.

Vendor rating systems and vendor consolidation programs are not a passing whim. They are rational, economically based responses by our customers to their emerging understanding of what our friends at TI call the "cost of ownership." In the QIP community, it's called the "cost of poor quality," or what Ray prefers to call, the "cost of waste." Vendor qualification reduces both the combined cost for us and our customers, as well as significantly reduces their time to market and manufacturing cycle time. It's a concept that's here to stay and an opportunity for us to significantly increase our penetration in existing and future customers.

Let's return to our QIP goals. We can summarize the external levers, those vital few improvement areas that will increase our customer ratings, as: the right products, delivered defect free, on time, and within an acceptable lead-time. JIT is relentlessly driving the last of these levers.

To activate them, while keeping our eyes on our overall business objectives, particularly the last one, there are a number of internal levers that we need to energize. Short time to market drives our ability to efficiently provide our customers with an increasing number of improved solutions within their market window. Low process ppm allows us to achieve world-class outgoing ppm levels without recourse to excessive inspection. Short manufacturing cycle times will help us match our customers' lead-time requirements without the need for inordinate inventory. The last internal lever, yield improvement is in my opinion the first among equals. It is the key to reducing our large yield variability, which in turn will contribute to better on-time delivery as well as reduced cycle time and increased effective capacity.

The notion of improvement curves and half-lives seems to have caught on as a useful QIP planning tool here at Analog. The half-life represents an approximately constant number of months needed for each halving of a defect level. In the next slide, I'd like to show you how we have used the concept to arrive at what we believe are a realistic, achievable set of aggregate corporate QIP goals.

Slide 4

ADI QIP GOALS			
IC OPERATIONS, ESTABLISHED PRODUCTS			
METRIC	1987	HALF-LIFE	1992
EXTERNAL			
On time delivery	85%	9	>99.8%
Outgoing defect levels	500 PPM	9	<10 PPM
Lead time	10 wks	9	<3 wks
INTERNAL			
Manufacturing Cycle Time	15 wks	9	4-5wks
Process Defect Levels	5000 PPM	6	<10 PPM
Yield	20%	9	>50%
Time to Market	36 mths	24	6 mths

WHILE AGGRESSIVELY PURSUING
CORPORATE-WIDE COST MANAGEMENT

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The first column contains the primary set of metrics, which evolve out of our corporate QIP objectives. The column labeled 1987 represents typical values for these metrics in our IC operations. The middle column is the assumed half-lives and is based upon our sense of the complexity that is involved. The final column is the resulting 1992 goals. Let me first emphasize that those are not our expectations for new, beyond the state of the art products, built on our latest advanced processes; they would not be our customers' expectations for these products either. What they do represent is what we can and must expect for our established, mature products, which at any point in time will represent well over 80% of our business.

99.8% on-time delivery means that we will rarely shut down our customers' JIT line because of our parts are late. JIT does not give them the flexibility to substitute another assembly for the one awaiting our part. The customers' cost for an idle assembly line is very high and very visible to them.

Less than 10 ppm incoming defect levels are essential as our customers eliminate incoming inspection and insist on ship-to-stock, or better yet ship-to-insertion from their vendor partners.

Today, a number of our customers require contractual maximum lead times of 10 weeks and some of them have announced that by 1992 that requirement will drop to below 4 weeks. This is not only driven by JIT, but also by their customers' lead-time requirements. Furthermore, short lead-times minimize the need for demand forecasting and the resulting all too frequent mismatches between actual supply and demand.

Clearly, we could achieve all of these external metrics today by relying on inventory and inspection. However, we'd grossly miss our profitability objectives, not only in magnitude, but I'm sure, also in sign. We need to back up our external performance with essential internal improvements.

To efficiently meet our customers lead-time requirements, we should strive to reduce our total manufacturing cycle-time.... in IC operations, that's silicon in to final shippable product out.... to less than their requested lead-time; that essentially means build to order rather than build to forecast.

This is the only QIP goal that has generated significant dissention. I call it significant because I'm the dissenting party. There is general agreement that today, the theoretical minimum IC cycle time is in the 4 to 5 week range, and that strategic die inventories will be required in order to provide lead-times below 3 weeks. I bet that by 1992, innovations at ADI in manufacturing will permit us to drive the manufacturing cycle time below 3 weeks.

It is probably impossible to achieve 10-ppm outgoing defect levels through inspection. Sampling plans yield sample sizes approaching lot sizes. At these low levels, any form of human intervention in the inspection process will assure that a significant number of defective parts will pass undetected. The only viable answer is to reduce our process ppm, the first-time-defect-level to below 10 ppm and eliminate inspection as a quality filter.

I talked about yields earlier. Our historic yields have been abysmally low, to say the least. As average yield increases, yield variability drops, production planning improves, cost goes down, and effective capacity increases. Not too many businesses can look forward to the potentially favorable impact of a tripling in shippable product per wafer processed.

Our final QIP goal is time to market. It is our greatest conceptual challenge. There is no one out there to learn from. I was recently visiting with my counterpart Craig Walter at HP. Time to market is HP's number one corporate objective. I doubt if it's a new one for them, but it's finally risen to the top of their Pareto analyses. It is another prime opportunity for beyond the state of the art performance from Analog Devices.

There's a little hooker hidden at the bottom of this slide. It's a theme that I've struck a number of times earlier. There's an old debate around the question of whether cost and quality are trade-offs. Some argue that to improve quality, cost must increase. Let me assure you that cost reduction and quality improvement are not tradeoffs; they are partners. At every step of the way, we must pursue both quality and cost improvement simultaneously, and challenge any actions, which suggest a compromise.

As a final note with regards to these goals, I urge you to judge them, not in any absolute sense, but relative to our competition. Talk to Brian McAloon and anyone else you know who has extensive outside experience in our industry to find out what represents world class performance. And don't be tempted to right off our digital IC comrades as having an easier job. Linear IC's are different, you might say. But to the customer, they're not. When it's lack of our parts, time and time again that is shutting down an assembly line, when it's our parts that are the cause of re-work or warranty claims, the customer doesn't accept excuses. The linear IC manufacturer who can deliver world class value, will reap the rewards. I believe that if we can achieve these goals, that manufacturer will be Analog Devices.

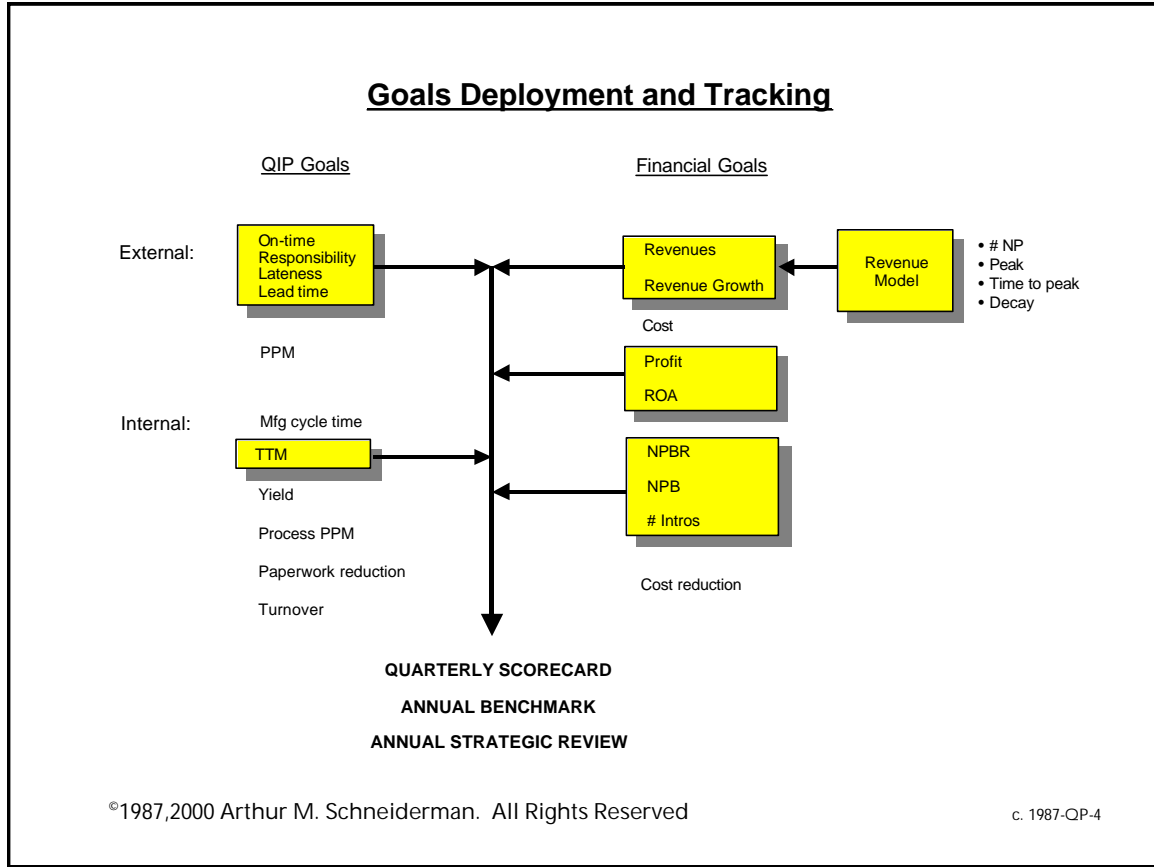
The process of goal deployment can't end with this slide. This represents a satellite view of the ADI of 1992. We are in the process of developing a means for deploying these top down goals throughout the organization. We need to translate them into division and entity goals that are customized to each specific situation. When the bottom up results are aggregated, we expect them to look very much like this, but there certainly will be many differences between individual divisions and between divisions, sales entities, staff function, and support groups. The resulting QIP goals deployment will assure that we are all playing to the same score and that the results are music not noise.

Let's move now to the topic of QIP metrics.

Having defined our Corporate Objectives and set continuous improvement goals, the logical next step is to develop a means for tracking progress toward those goals. This tracking system must have certain basic characteristics. First, the metrics must be quantitative rather than qualitative. They must be measurable, unambiguous in definition, and as simple as possible. They must be directly related to our Corporate Objectives, or if necessary be effective surrogates for these objectives. They must be a comprehensive set so that we are assured that if all of them improve we are sure that our objectives will be advanced. I'll talk more about this aspect when we review the customer service metrics. Finally, they must be matched to the organizational structure so that a single individual can be identified who has responsibility, accountability, and clear ownership for each metric.

QIP Strategy Presentation, c. March 1988

Our metrics system identifies both QIP and financial goals. This display shows our existing set of metrics boxed in yellow. The others are under development.



On the right hand side of this chart you see a number of familiar financial goals. We've recently supplemented them with a simple Lotus 123 divisional revenue model that relates future revenues to the annual number of new product introductions and their actual or expected revenue profile. The model gives us a very useful means for relating our overall macro objectives to the micro actions in both design and marketing that are required to support them. It has helped us reaffirm the need for significant reductions in time to market if we want to resume our historic high growth rate.

Another thing that you see in our financial goals is the word cost. In the past, knowing our costs in detail would probably not have affected any of our major business decisions. That will not be true in the future. We will need to know our product cost in detail in order to make resource allocation, site selection and pricing decisions. This will require the installation of a corporate-wide standard cost accounting system which fully allocates all of our costs in ways consistent with our own move to JIT manufacturing. This system will also highlight the cost of waste and help us identify the greatest opportunities for real, bottom line improvement. Once in place, we will be able to set aggressive cost reduction goals, many of which will be achieved through our QIP efforts.

On the QIP side, you see the familiar customer service metrics. We have been publishing on time metrics for several years now. These metrics track the % of lines shipped on schedule in a given month. They can be broken down by division, customer, customer type, and order size.

Slide 6³



Here's an example derived from our latest report. It shows both the level and rate of improvement. The trend, in many instances, is very encouraging; but, as you can see, we still have a ways to go. I've seen the February preliminary results; there'll be at least 4 divisions below 10%, and lot's of justifiable celebrating.

We have recently supplemented these with what I use to call the "finger pointing metrics." They assign responsibility for each late line to either the factory, credit, warehousing or the customer. It is these metrics that each of those groups directly control. Soon to be added are the lateness metrics that track both "when late, how late" and "still late, how late." Finally, the lead-time metrics track both the customers requested lead-time and the factory quoted lead-time. Our objective here is to drive that difference to zero.

These four metrics represent a comprehensive set of delivery metrics. If each of them is improving, we can be assured that on average we are getting better. Without any one of them, we risk the possibility that in our eyes we're progressing, while in the customer's, we're getting worse.

³ Actual slide was Feb 88 version of this one.

Ray has recently given me responsibility for dealing with quality issues that require a corporate rather than a divisional response. One of these issues is a single, corporate-wide definition of outgoing ppm. This is necessary so that our customers, for example, are able to make rational decisions on incoming inspection policies. Once defined, outgoing ppm will be added to the formal list of metrics.

We have developed a time to market tracking system, which follows each new product from the start of the design process to introduction. Within the divisions, project management tools are being developed that will both illuminate the new product development process and address the question: "when late/early, why late/early" for use in QIP project identification. This tracking system also provides quarterly updated inputs to the revenue model. I hope that as we develop confidence in these metrics they will have the added benefit of providing a context for our expense planning activities.

Manufacturing cycle-time, yield and process ppm are currently measured at each division. We will also be developing common definitions for these manufacturing metrics. One interesting use will be by the Manufacturing Council. We plan to review the best-demonstrated practices at our meetings as a mechanism for cross-divisional experience sharing.

The last two metrics are currently the least developed and are there to represent our intention to also introduce metrics in the areas of information systems and human resources. They are clear examples of surrogate metrics and will need to be supplemented by internal customer satisfaction indices.

The duality between QIP and financial goals that you see here is more than a graphical convenience. Our QIP strategy hinges on the elevation of QIP goals to the same level of importance as our historic financial goals. Some would argue that they are in fact the drivers and that financial performance is the result of their successful achievement. Today's financial systems go back several hundreds of years, QIP metrics, more like months. Today, we need to view these metrics as evolving and constantly in need of refinement.

All of these metrics feed into a review process that involves the quarterly scorecard, annual benchmark plan, and what is likely to be an annual strategic review carried out by the corporate strategic planning committee. The spirit of all of these review activities must include the constructive identification of problems and the appreciation of corrective action...how's that for a 50 cent word? They should also provide a vehicle for the early surfacing of new opportunities.

Finally, we need to always keep our overall business objectives in mind, remembering that they are the ends, and the metrics are the means. When conflict arises, our business objectives should always govern.

QIP training is essential if we are to achieve the aggressive rates of continuous improvement that we have targeted. We have purposely delayed QIP training until the point in time when you, our customers, have expressed a need. Well, that time is here. Feedback from the QIP teams has now passed the point where more than 50% of the participants have expressed a need for further training. We've put together a two-phase program in response to that need. I will not go over it in detail today. Instead, I'll describe its elements.

<u>ADI QIP TRAINING PROGRAM</u>	
<u>PHASE I</u>	<u>PHASE II</u>
PROOF OF THE NEED Customers (JIT, VENDOR PROGRAMS) Competitors (TI Hiji, JIT Programs, Japan) COPQ/ "Cost of ownership"	IMPLEMENTATION Project selection Cross-functional problem solving QIP team management - QIP vs. un-QIP teams - QC Circles
WHAT IT TAKES Top management commitment Sense of urgency Systematic approach Pilot projects Company wide involvement Organization/Systems	TOOLS 7 basic 7 new Design of experiments (Taguchi) Role of automation
ADI QIP DEPLOYMENT Organization Goals deployment - strategic plan - benchmark plan	TRAINING On the job, JIT Role of statistics Cross training Multiple skills
PLANNING TOOLS Improvement curves/ kaizen Optimum quality levels Cost of waste	INCENTIVES Bonus system Performance review QIP Promotion
	THE FUTURE Organization simplification Vendor customer relationships Marketing/selling QFD, TPM, ... Fun, Fun, Fun
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Phase I has the objective of assuring that every single employee of Analog Devices has a shared understanding of QIP, and furthermore that every manager and supervisor understands it well enough to teach it to his or her direct reports.

The material that we cover will include proof of the need for QIP, the six requisites for success, our QIP goal deployment system, and an introduction to the QIP planning tools, along with a discussion of their underlying rationale.

In this first phase, we will be using manager trainers. In other words, each manager will be personally training his or her direct reports. By the end of this fiscal year, each ADI employee will have received phase I training.

By that time, working with our corporate training department, we will have developed a complete set of phase II, or "how to do it" training materials. These will cover implementation techniques, tools, training, incentives, and future trends in QIP. Unlike phase I training, phase II training will not be mandatory. When you feel that you need it, it will be available. However, lack of QIP training better not appear twice on anyone's Pareto analysis.

QIP is a team approach to problem solving. In a sense it is the antithesis of heroics, another well-known approach. It is characterized by small steps that build on the incremental contributions of individual members. Credit is hard to assign to any one person. Let's review how a QIP team operates.

Slide 8

A QIP Team:

- Has a Clearly Stated Objective
- Has Regular Meetings
- Is Cross-functional
- Uses an Organized Systematic Approach
- Emphasizes Data Collection and the Use of Statistical Tools
- Is Fun and Gets Results

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Starting with a clearly stated objective, the QIP team meets regularly, usually weekly or at most biweekly. Attendance is high because the team can't function well even if a single member is absent. The secretary publishes timely minutes. Tom Urwin holds the record here. Tom chairs the Euro-Marketing QIP, which meets at our affiliate office in Walton in the U.K. By the time I get back to my desk in Wilmington, the minutes are usually there. I've thought of the Concorde, but it can't compete with the fax. By nature persistent problems are almost always cross-functional in nature, so the QIP team usually includes people from different areas: sales, accounting, marketing, manufacturing, design for example. These teams use a structured approach, with emphasis on data collection and statistical tools. A working QIP team always passes two critical tests: the members have fun and they get results.

If you're on a QIP team now, and it doesn't operate this way, give me a call and we'll see what we can do in advancing your training schedule.

In closing, let me make two assertions:

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First, QIP is here to stay. Our challenge now is to absorb it into our corporate culture as rapidly as possible. Skepticism is usually healthy and well founded. However, this is the time to set skepticism aside and give QIP a try. As the old saying goes, "try it, you'll like it." In all fairness though, QIP's a little like Guinness beer, for some it takes a little getting use to.

Second, QIP is the highest performance improvement tool in the market. It's a great match to our product line and a super partner with innovation. Together, I have no doubts that our strategic plan can not only be met, but significantly exceeded. I for one, look forward to that challenge.

Thank you.