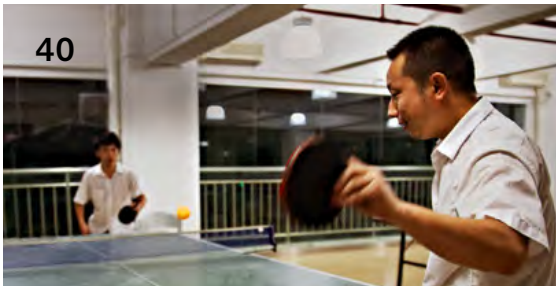
NCAB GROUP

INFOCUS:

9 key topics for the PCB market

A collection from NCAB Group about integrated PCB production



PRINTING: **STROKIRK LANDSTRÖMS 2015**
PAPER: **GALERIE ART GLOSS, COCOON OFFSET**

DESIGN: **TILLS.SE**
PHOTO: **JESPER FERMGÅRD & NCAB GROUP**

SANNA RUNDQVIST
EDITOR & MARKETING MANAGER
NCAB GROUP

Our best thoughts, so far, in 44 pages

The sharing of information and transparency is an important factor for any business.

Our newsletters are an effective way to spread and share the collective knowledge that we have within the NCAB Group. Today, these newsletters are published in 10 languages and reach approximately 40 markets and 3000 customers worldwide. We are constantly striving to keep both a technical and commercial focus, where current topics are reported on, aimed at supporting our customers in their daily work.

Due to positive response, we have collected some of the most interesting articles over the years into a single issue. We hope this will provide you with new ideas and also update you on other, relevant topics of interest.

Feedback is highly valued by NCAB Group, so should there be a topic that you would like to learn more about, please do get in touch with us and tell us more.

To ensure that you regularly receive a copy of our newsletter, please contact your local NCAB company.

Happy reading!

CONTENTS

Continued rapid growth expected in China

Developments in China are having an increasingly significant impact on our branch. The PCB industry there has grown very rapidly since 2000 and today China is the biggest producer of PCBs in the world. In this newsletter, head of the NCAB Group's operations in China, Jack Kei, gives us his view of developments there.

Jack Kei, Managing Director, NCAB Group China.

LOW CONSUMPTION CHALLENGE

This year has seen the economy start to recover after the crisis and the forecast for China points to an expansion rate of 9.5%, which can be compared to the equivalent figure for global growth of 4%. However, Jack feels that while growth in China will remain at a high level during the next five years, it will not do so at the same speed as the decade preceding the crisis.

Jack does not foresee a repeat of the 15% growth rate levels, due to character of the Chinese economy. “The government makes major investments, while consumption remains low. We have a rich state, with a less rich population.” he says.

Economic policy in China is thus focusing on increasing income levels. These have risen by 17% on average this year and wage costs will continue to rise in the years to follow.

“This is basically positive for the economy.” says Jack. “People have more money in their pockets for consumption, which makes for a healthier economy and encourages growth. At the same time, the government will try to keep inflation stable.”

CURRENCY INCREASING IN VALUE

The exchange rate between the Chinese currency RMB and the US dollar is another current issue. The United States has been unhappy with China’s currency policy, saying that it gives China unfair trade advantages.

Jack says that this is basically a question for President Obama and Premier Wen to sort out. “We are of course keeping an eye on developments. This year, the exchange rate against the dollar fell from 6.85 to 6.70 and I think this trend will continue. Economists are saying that in a few years’ time, the exchange rate will settle at 6.50, providing we don’t get a new recession.”

On the question of when we may see a democratization of the political system, Jack thinks that the current focus in China on earning money will continue for some time to come. It won’t be before everyone has attained a more comfortable living standard that the issue of real democracy will be seriously looked at.

Bigger and fewer factories

Anna Lothsson, Strategic Purchasing Manager; Jim Liu, Factory Supervisor and Aaron Dai, QC Engineer from NCAB Group follow-up corrective actions from the previous audit in one of our main factories.

THE FACTORIES SURVIVED THE CRISIS

Turning to the PCB industry specifically; it started on a modest scale back in the late 1980s, but didn't really take off until 2000. In the years before the crisis, the industry expanded at an annual rate of 18%. During 2008 and 2009 it declined 5.2%, which was still far lower than the corresponding figure of almost 15% for the world as a whole.

Jack recalls that almost everybody was expecting many PCB factories to disappear. "However…" he says, "…we have just about the same number of factories today as before the crisis, about 3000 units. Many factories, about 20-30%, did have to close down, but since there was plenty of risk capital available in China, new investors moved in when those factories went bankrupt."

The state's efforts to build up, for example the 3G mobile network, helped to maintain demand for PCBs during the crisis. 2010 has marked the start of a strong recovery process within the PCB industry, which has expanded 18.6% in China, 5% more than the global industry as a whole.

NEW FACTORIES INLAND

"What is going to happen during the next five years is firstly that new factories will be established inland in eastern China rather than by the coast." says Jack. "This is a consequence of stricter environmental regulations and increased labour costs. Secondly, it will become harder to persuade people to move to the developed regions by the coast, as it is becoming easier for them to find work in their own regions."

The establish factories in Shenzhen and other coastal cities will continue to operate there, but to meet increased capacity needs, manufacturers will build new factories in new areas inland.

Jack Kei sees this as a positive development for the NCAB Group since, as he puts it: "It is possible to restructure operations in a favourable manner. The old factories on the coast can be used for more advanced manufacturing and the new ones inland, for more basic manufacturing at a lower cost."

BIGGER AND FEWER FACTORIES

Another clear trend within the Chinese PCB industry is that the major manufacturers are becoming even bigger. We are seeing a concentration to bigger and fewer factories. Prior to the crisis, the hundred biggest factories had 40% of the business. Today that figure has increased to 60%. This is a natural development considering the challenges that the industry is facing today.

"The biggest challenge is the rising costs." says Jack Kei. "Raw materials such as copper, gold and chemicals are becoming more expensive and their prices will continue to rise during the next few years. As I mentioned, wage costs will also increase, while the rate of exchange will move to levels that will impact negatively on China's exports. To deal with that, we need to increase efficiency."

Manufacturing costs can be reduced by the factories extending their capacity and thus gain economies of scale. The factories are also considering a variety of measures to boost their cost efficiency, such as personnel cuts and increased automation. They are also aware that improved quality also leads to lower total costs and are focusing on ways of improving the quality of their products.

Jack Kei is convinced that China will, despite its cost issues, manage to retain its strong position as a PCB manufacturer and continue to expand faster than the rest of the world during the next five years. "No other low-cost country…" he concludes "…can boast such a mature and well established delivery chain within this area."

"The biggest challenge is rising costs. To deal with that, we need to increase efficiency."

JACK KEI, MANAGING DIRECTOR, NCAB GROUP CHINA

THE PCB INDUSTRY IN CHINA

- China accounts for 35% of global production, making it the biggest single producer of PCBs.
- Between 2000 and 2007, China's PCB industry expanded by 18% on average .
- The industry declined in China by 5.2% in 2008 – 2009 compared to a global decline of 14.8%.
- It is estimated that the industry in China will expand by 18.6% in 2010, compared to 13.6 in the rest of the world.
- China's PCB industry is expected to grow faster than anywhere else during the next five years.
- 60% of China's PCB factories are situated in southern China, 30% in eastern China, which is now expanding rapidly, and 10% in northern China and other regions.

Increasingly important to adapt rapidly in the electronics industry

The European electronics industry is undergoing major changes in the wake of the financial crisis. The NCAB Group's Vice President, Martin Magnusson sums up developments and tells about the NCAB Group's plans for the future and what those will mean for customers.

Jim Liu and Anna Lothsson, NCAB Group together with Mark Mai Sales Director and David Wu Sales Manager, Ellington, heading for a Factory meeting.

CONSOLIDATION STRONG TREND

"With businesses falling by the wayside, the recession has led to a consolidation of the EMS branch. We're seeing a trend towards fewer and bigger players on the market. These companies are, at the same time, becoming increasingly global and setting up manufacturing units in low cost regions."

Of the 1300 EMS companies in Europe, 56 companies, whose turnover exceeds 50 million euro, account for two thirds of the branch's total annual turnover in Europe; in black-and-white figures, that's 14 of a total of 21 billion euros

"Despite the consolidation trend, small and medium-sized EMS companies are still able to grow by cleverly adapting to their local market conditions." says Martin.

"The growing number of global companies that emerged as a result of the consolidation process is one of the reasons why we have chosen to establish ourselves in England, Poland and the Czech Republic, as well as strengthen our organization in Germany and China." Our next step will be France, where operations will be under way at the beginning of the second quarter 2011."

At the same time, Martin underlines that the NCAB Group's objective is not just to establish a presence in a large number of markets. "What's important is to be able to provide service in the markets where the customers are physically located. He says that to achieve this, the NCAB Group needs a local presence and competence.

He emphasizes that: "To be able to offer a high level of service to our customers, we need to be on the spot."

There is also an ongoing consolidation process taking place at the PCB factories in China. There, large volumes are a vital factor in ensuring that a buyer's requirements are met. The NCAB Groups' large and growing purchasing power is a definite advantage in this context.

"Thanks to our size, we are learning more and more all the time. This year we will be manufacturing 8000 new PCB designs and we are also continuously building up our knowledge bank in collaboration with its factories and customers." Martin underlines.

OUTSOURCING ON THE INCREASE

The outsourcing trend, which has come far in northern Europe has now reached central and southern Europe. An increasing number of OEM companies are now outsourcing their manufacturing operations to EMS companies.

"The outsourcing trend has also led to steadily growing demands on quality and delivery precision, with the biggest driver being the automotive industry. The NCAB Group is currently running an internal project aimed at meeting the automotive industry's quality requirements. The objective is to achieve 10 PPM (Parts per Million). To better fulfill these customers' demands for 100% delivering precision, the NCAB Group is continuing to develop its internal systems.

We are today working on an IPL (Inventory Planning System) in order to handle forecasts and are continuing to implement our global ERP and CRM systems at all our companies and are also developing a tracking system together with DHL Global Forwarding in order to further improve our tracking ability in the delivery chain."

EARLY ACCESS TO KNOW-HOW

"Another challenge is facing the EMS companies, namely that they must be able to handle many different customers with a variety of requirements, which puts greater demands on cost control and short production lead times." says Martin.

To achieve this calls for access to PCB know-how, as well as bringing in the EMS company and PCB producer earlier on in the production chain at the end customer. This to ensure that the correct choice is made already at the design phase. This enables us to control the total manufacturing cost while at the same time cutting lead times.

"This is where the NCAB Group comes in with its in-depth know-how within PCBs and the extensive quality control and follow up processes we implement in our factories in China." says Martin.

Through its strong presence in China together with working closely with the factories to develop them, the NCAB group can also guarantee a high and even quality in its products. Continuous audits are carried out to keep a check on the factories in a way that would be extremely difficult for individual buyers to do by themselves.

"We carry out about 250 factory visits every year. That's why when our customers call us, it is for them as if they were talking directly with the factory. We control the entire process, which benefits all our customers, be they large or small." says Martin.

GROWTH DESPITE A TIME OF CRISIS

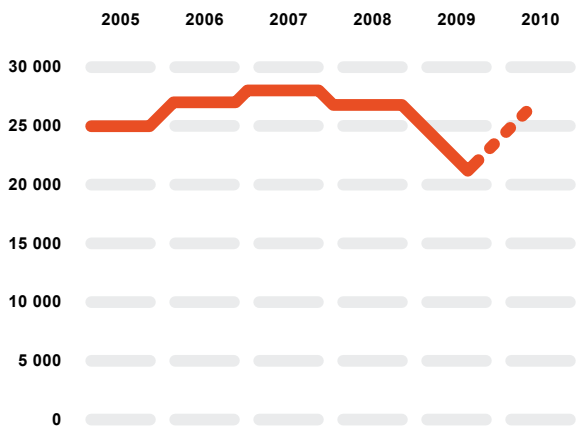
Along with the rest of the electronics industry, 2009 was a tough year for the NCAB Group. However the company managed to continue growing even during the crisis, recovering in a spectacular manner. 2010 saw the NCAB Group's turnover grow by 80%. Incoming orders were up 93% compared to 2009. The target for 2011 is a growth rate of about 25% compared to 2010.

The NCAB Group is continuing to develop its work approach according to the integrated PCB producer (IPP) concept. The process involves integrating both with the customers and further back in the supply chain, with the factories.

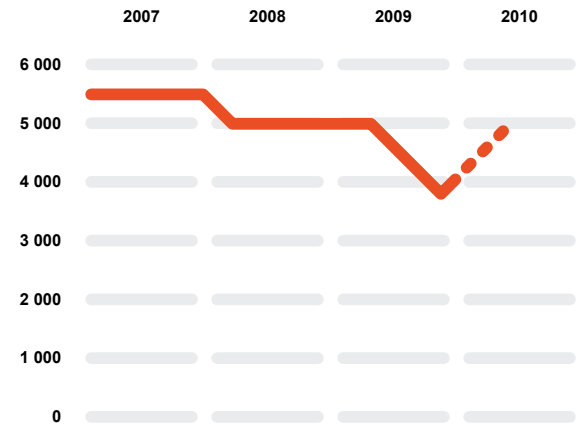
"Yet another step in the integration process with our factories is to have our own quality engineers on the spot, full-time, to monitor our orders on the production line.

With local support and early involvement in our customers projects, we can together secure the correct choice of design from the start in order to save costs and avoid problems later on in the process." concludes Martin.

THE GROWTH OF THE EMS MARKET IN EUROPE [MEUR]

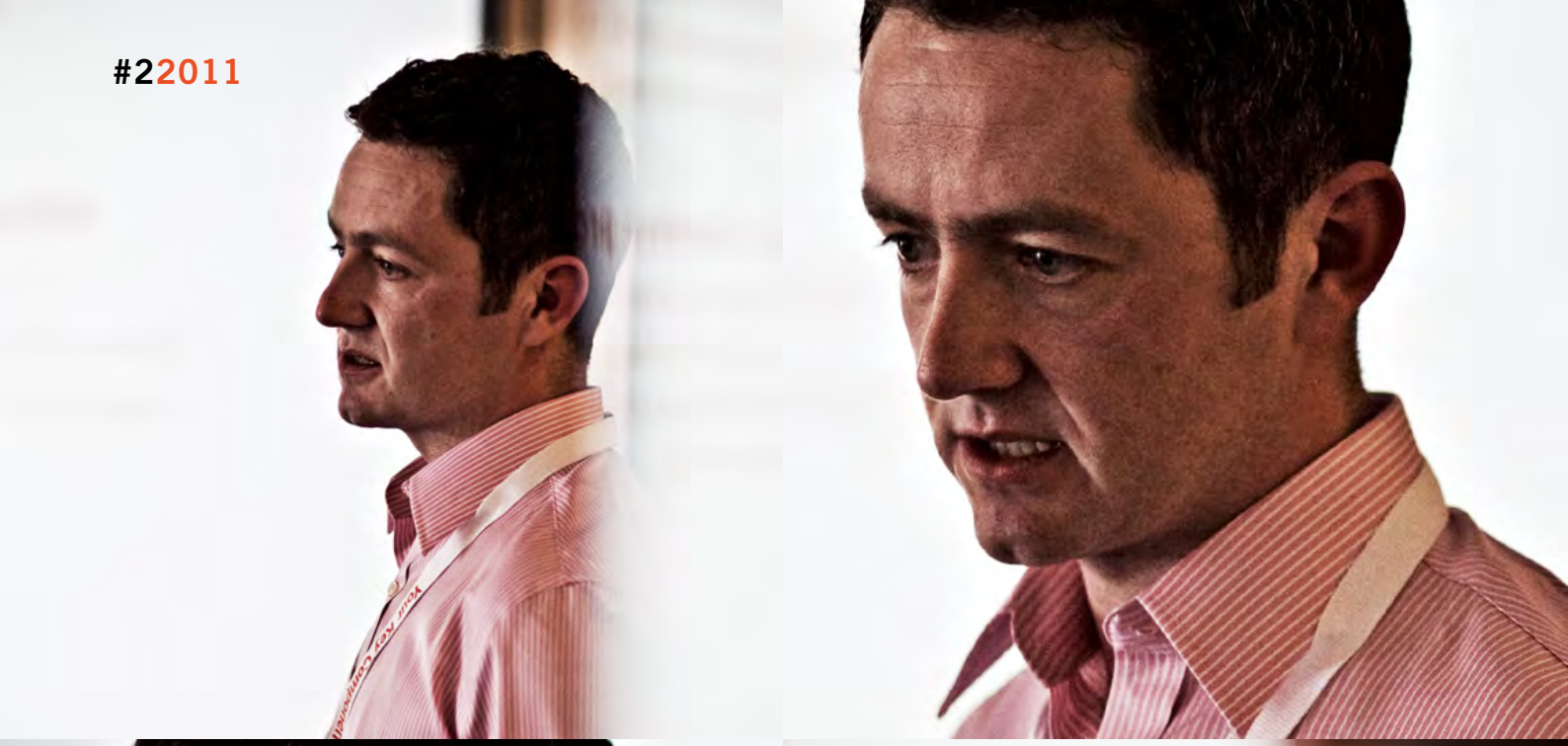


THE GROWTH OF THE PCB MARKET IN EUROPE [MEUR]



"We carry out about 250 factory visits every year. That's why when our customers contact us, it is for them as if they were talking directly with the factory."

MARTIN MAGNUSSON, VP SALES AND MARKETING, NCAB GROUP



100% quality achieved through control of all details

Chris Nuttall has been in charge of quality and technology issues at the NCAB Group Since early 2011. He believes that attaining the highest possible quality can be only be achieved by focusing on all the individual details - from design input through process improvements and onto delivery. So far, the figures are pointing in the right direction, but he stresses that the NCAB Group are only as good as their latest delivery and there is no place for complacency.

"I was not entirely convinced that it was appropriate to include willingness in the rankings. But in the end it is people who can make the difference and I have come to realize that both performance and willingness are prerequisites for achieving the set objectives."

CHRIS NUTTALL, CHIEF OPERATIONS OFFICER, NCAB GROUP

"Continuous improvement is the focal issue for all quality managers and there is a real openness here to work on this in all areas of the organization."

QUALITY THE NUMBER ONE PRIORITY

Chris has extensive experience of working with the quality and performance requirements applied in the automotive industry. As a result he has brought in a high degree of quality consciousness to his new role, which is something he believes is right in line with the times:

"Earlier, only customers from the automotive industry demanded that manufacturers lived up to their (automotive) standard of quality. Now we're seeing other clients as well demanding this. Quality expectations and demands are today increasing across the board." he says.

The NCAB Group's vision is to deliver PCBs with zero defects. The quality as perceived by the customer experience is top priority in everything we do and, as Chris Nuttall puts it, the NCAB Group is only as good as its latest delivery. What then, is the NCAB Group doing to live up to its vision?

Chris emphasizes that quality is something that can best be managed by focusing on the individual details all the way from design right through to delivery. In addition, it is vital to identify the processes across the entire flow in detail. It's only when you have that level of overview that you can plan for quality throughout the supply chain. He says that it is not only up to him to achieve or influence that. As quality manager, he says he can contribute ideas and support when needed, measure the results and reconnect them to help steer the boat in the right direction, but emphasizes that the quality of NCAB's deliveries is dependent on everyone involved at every stage.

CAN ADD VALUE AT THE DESIGN STAGE

The prerequisites that ensure that customers get the quality they want at the best possible total cost can really be determined at the design stage. If the NCAB Group, with its manufacturing expertise, can be brought into the process and add value right from the PCB design stage, it can ensure that the PCBs are designed for volume production.

"Customers in the automotive industry, for example, Stoneridge, have benefited from our expertise at the beginning of the supply chain. The players in this branch expressly seek the best possible quality at the lowest possible cost. Once we get the opportunity to show how we can add value, the customers can realise the extent of the benefits gained through designing for the entire life cycle, compared with, for example, just choosing a design that is optimal for the prototypes." explains Chris.

DEVELOPING THE FACTORIES

The next stage in the chain involves developing processes and technologies for PCB manufacturing in the factories. In this context, the NCAB Group team in China plays a crucial role. They work closely with the factories that are ranked on the basis of both performance and how willing they are to work with the NCAB Group to develop their quality and delivery capabilities.

Initially, Chris was not entirely convinced that it was appropriate to include willingness in the rankings. But he concluded that in the end it is people who can make the difference and he has come to realize that both performance and willingness are prerequisites for achieving the set objectives – what is more important, the mindset to improve or having the skills but no desire to improve on them?
Furthermore, having quality control on the spot in the factories is crucial for the NCAB Group. In this context, Chris says that the group should work to improve its ability to make use of the statistics in targeting the regular audits carried out at the factories. That is why the NCAB Group has started to follow up the numbers every quarter in order to focus on the next quarterly audits. This to be able to constantly work on the areas that specifically need improving and very quickly and visually seeing where we are still to improve.

"We have the biggest and best factory management team in place in China and they are working hard to help the NCAB Group to keep our promises to customers." says Chris. "We are present at the factories, where we always play a constructive role, since the factories we work with are focused on developing and improving themselves. We want to get the right procedures, processes and methods of verification in place to enhance quality." he concludes.

POSITIVE PPM DEVELOPMENT

For the NCAB Group, Quality assurance is much much more than applying various criteria to the product itself. What is equally important is to look at the process, tools and people who use them. Naturally, product monitoring is, at the same time, also essential. One of the key indicators to monitor quality is measured in the number of incorrect order lines in relation to the number of delivered order lines. Another are the PPM (Parts Per Million), as historically driven by the automotive industry.

"We are moving in the right direction, so I'm relatively satisfied. But the journey isn't over." says Chris. "When customers purchase a PCB, they want the right quality, at the right price and delivered on time. Part of my role is to ensure that quality is the outstanding feature of the NCAB Group. With some customers, we have reduced the annualised figure to 15 PPM, which is very good. We should never rest on our laurels however, but rather constantly work to further improve ourselves." Chris underlines.

In China, the NCAB Group is working closely with the factories that are ranked on the basis both of performance and how willing they are to work with the NCAB Group to develop their quality and delivery capability.

Alen Chen, QA Engineer NCAB Group Factory Management team together with Zaiyong YI, Production Supervisor, Suntak during an audit.

THE 8-D METHOD WHEN THINGS GO WRONG

But even if zero defects are a goal and vision, things can sometimes still go wrong. When that happens, Chris would like to treat it as an opportunity to show what you can do to recover. The NCAB Group would in such cases assume responsibility for its entire supply chain backwards. You take control of the situation by using the 8D methodology (see box) and taking measures to correct the problem.

"If we find ourselves with our backs to the wall, we should use it as an opportunity to show our customer the value we're providing them. We make sure that production keeps running even when something goes wrong and we identify what needs to be done at the factory to contain, resolve and prevent future problems. All the while being fully transparent with the customer so they know exactly what we are doing to in all areas – without such awareness how they can be confident or feel secure that we are making them our primary responsibility." Chris explains.

MORE CONTROLS PRIOR TO VOLUME PRODUCTION

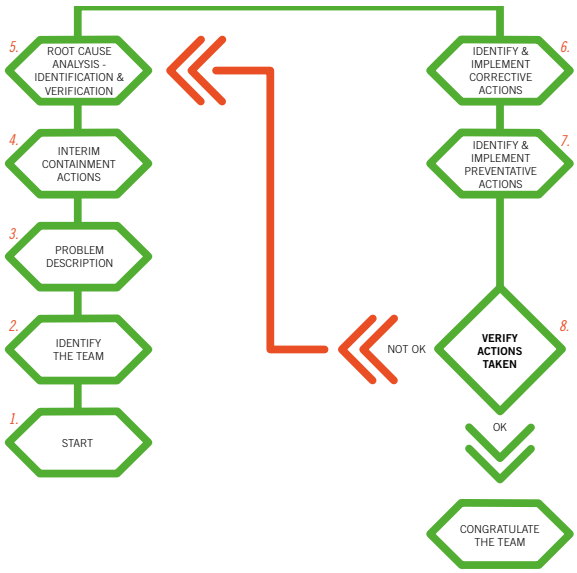
One thing NCAB Group's quality and technical manager would like to see more of are control measures implemented before the factories start up volume production. That way you can identify potential risks before production gets going.

Chris Nuttall feels that the NCAB group possesses a clear advantage through having local people on site and working with factories that in turn want to work with us. He points out that anyone who tries to do this from afar will get into trouble. "We have a quality team out there who are willing to work with change, while we have lots of good ideas. What we need to do now is just to introduce them at the right time." says Chris and concludes..."Consider that we are working on a painting, equipped with paintbrushes, colours and a canvas. We just need to bring it all together, in the right order, into a beautiful work of art."

"The NCAB Group possesses a clear advantage through having local people on site and working with factories that in turn want to work with us. Anyone who tries to do this from afar will get into trouble."

CHRIS NUTTALL, CHIEF OPERATIONS OFFICER, NCAB GROUP

THE 8-D METHOD



1. IDENTIFY THE TEAM
Define a team with the right level of knowledge, authority and skills to solve the problem, implement the right corrective and preventative actions. A team leader is essential.

2. PROBLEM DESCRIPTION
Detailed description using quantifiable terms, images and detailing all factory/traceability aspects. Also confirm if issue is concession/reject (both need action!) & if remakes are needed to keep lines running.

3. INTERIM CONTAINMENT ACTIONS
Actions necessary to 'ring fence' the problem providing total confidence that we have contained the problem within the supply chain - i.e. how to protect the customer until actions implemented?

4. ROOT CAUSE ANALYSIS
Failure analysis on any and all potential causes with detailed explanation as what could have caused the concern and the level of contribution per cause towards the problem (not always a singular event.).

5. CORRECTIVE ACTIONS - IDENTIFICATION AND IMPLEMENTATION
Definition of the actions undertaken to correct the problem - NCAB consider this aspect to be process focused and, again, each action shall have effectiveness in solving the issue defined.

6. PREVENTATIVE ACTIONS - IDENTIFICATION AND IMPLEMENTATION
The preventative actions are focused at the system to provide confidence that should similar process variation occur then these system based actions will prevent not only reoccurrence but escape too.

7. VERIFICATION OF EFFECTIVENESS
Final confirmation that the actions implemented will be 100% effective in the resolution of the problem without any negative or detrimental effects being caused to the customer.

8. CONGRATULATE THE TEAM INVOLVED
Not simply patting each other on the back! This section encompasses recognising the efforts of those involved communicating the actions taken in solving the problem. i.e. knowledge sharing.

China reforms

– changes in the Chinese economy

China's rapid growth during the past decade and the NCAB Group's desire to manufacture high-quality and increasingly more technically demanding PCB's at competitive prices have been instrumental in the NCAB Group's continued success within its markets. Since China's economy has a major impact on us all today, we are devoting this "In Focus" issue to examining the current economic situation in China and looking at possible developments in the future.

We asked Annika Lindblad, analyst specializing on China at the major Nordic bank Nordea in Helsinki, to guide us through a number of issues.

A much discussed question, not least regarding US-China relations, has been China's monetary policy. Where is China on that point today and what impact will its actions have in the future?

"China's currency is regulated, with the CNY (Chinese Yuan) allowed to float within a band of 1.0% against the dollar, and at an exchange rate determined by the Chinese central bank on a daily basis. Furthermore, the central bank is known to actively participate in the currency markets, selling and buying currency and thus steering the exchange rate.

There is nothing strange or divergent about China, as an emerging market, choosing to regulate the rate of exchange, as it facilitates stability. What is interesting now is the process China has initiated to ease the regulations. In April, the band at which the CNY was allowed to fluctuate widened from 0.5 to 1.0 percent, which constitutes a further move towards a freely floating currency. The driving force behind this process, which may take up to five or ten years to fully implement, is China's ambition to make the CNY a major global trading currency. A freely floating CNY would be particularly favourable for foreign and domestic companies and investors. On the other hand, I don't think that currency deregulation would have any significant effect on China's competitiveness and strength as a manufacturing nation.

Another sign of an impending deregulation is the test China has carried out with a new artificial floating currency CNH (offshore CNY settled in Hong Kong), which trades in Hong Kong. It is convertible against the CNY and can, for example, be used as a means of protecting the currency.

"They are apparently satisfied with an 8% growth rate in exchange for a balanced economy."

ANNIKA LINDBLAD, ANALYST, NORDEA HELSINKI

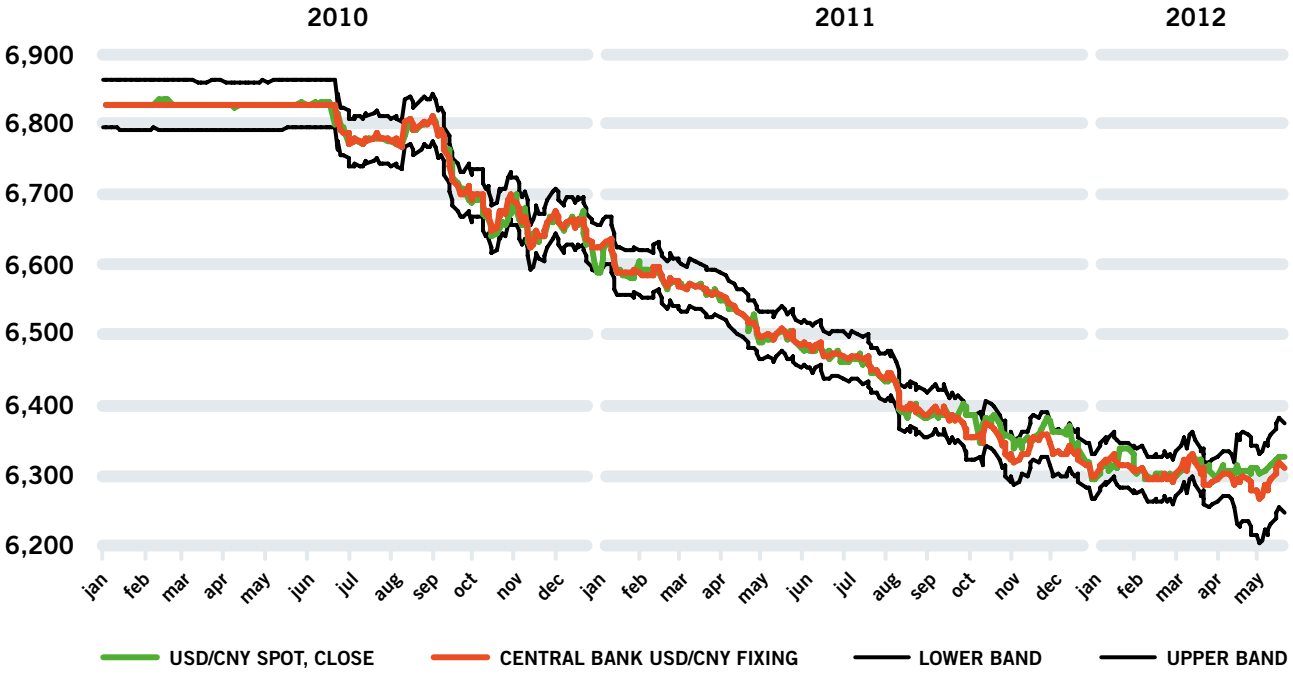
The two currencies have mostly remained on a par with each other, but it would be hard to forecast what might happen in a crisis situation. One could say the CNH is a way of testing a floating Chinese currency."

Income levels have risen sharply in China in recent years. What is this due to and what consequences will it have?

"Incomes are still rising strongly. Last year, workers who have migrated from rural China to the cities received average income rises of 21 per cent. This is linked to the strong economic growth and improved standards of living and is normal for high growth economies such as China. Furthermore, there has been a slowdown in the number of rural migrant workers, which also impacts income levels."

One development we may see, with China in some instances, no longer being the cheapest manufacturing country, is manufacturers moving their bases from China to such countries as Vietnam and Thailand. This applies mainly to the production of basic staple goods and indicates that China should focus on more sophisticated production and

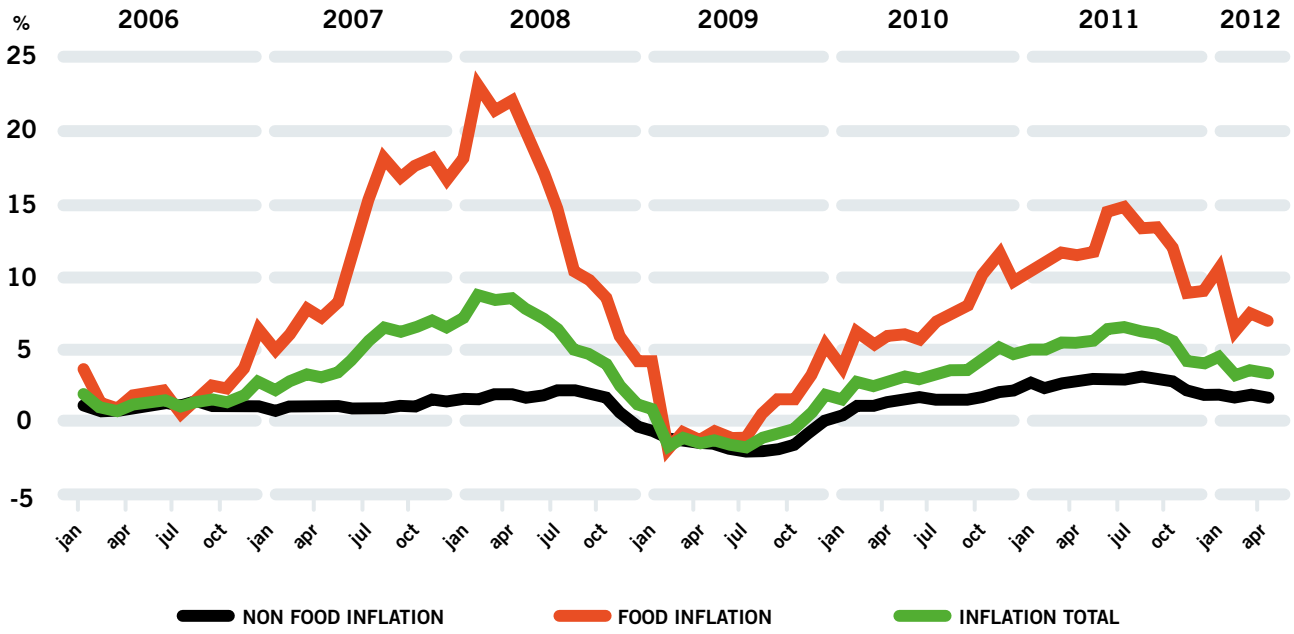
THE VALUE OF THE CHINESE CURRENCY AGAINST THE US DOLLAR



Source: Nordea Markets & Reuters Ecowin

After having appreciated some 30% against the dollar during the two previous years, China's currency, the CNY, has remained stable compared to the dollar.

INFLATION IN CHINA



Source: Nordea Markets & Reuters Ecowin

After peaking last year, inflation has fallen to a relatively low level, very much thanks to a fall in food prices.

on developing its service sector. One of the challenges the Chinese economy faces is to train its workforce to manage the transition to a level of manufacturing with higher quality demands.

We are also seeing tendencies for the manufacturing industry to move from the east coast to the less affluent inland provinces, in order to cut their costs. After all, China is and will always be a huge country, with a massive labour force. This process is still in its infancy, but it could also serve as a way of bridging the enormous imbalances within China. I don't actually have any reliable statistics to refer to, but to the extent that it is happening, it is probably mainly within the basic staple industries sector."

The Communist Party has been hoping to see a growth in domestic consumption, but growth has been slow due partly to increased housing prices.

There has also been much talk about the threat of inflation in China. How would you describe the situation with regard to growth and inflation respectively? And what effect is the crisis in Europe having on China?

"Economic growth has slowed down, but we've seen it stabilize at around 8 to 8.5 percent. Inflation has fallen significantly and is now under 4%, very much due to the lower cost of foodstuffs. China's exports to Europe account for a fifth of its total exports, so the European crisis is, of course having a negative effect. If the crisis is restricted to Europe, it shouldn't however, have any major impact on China.

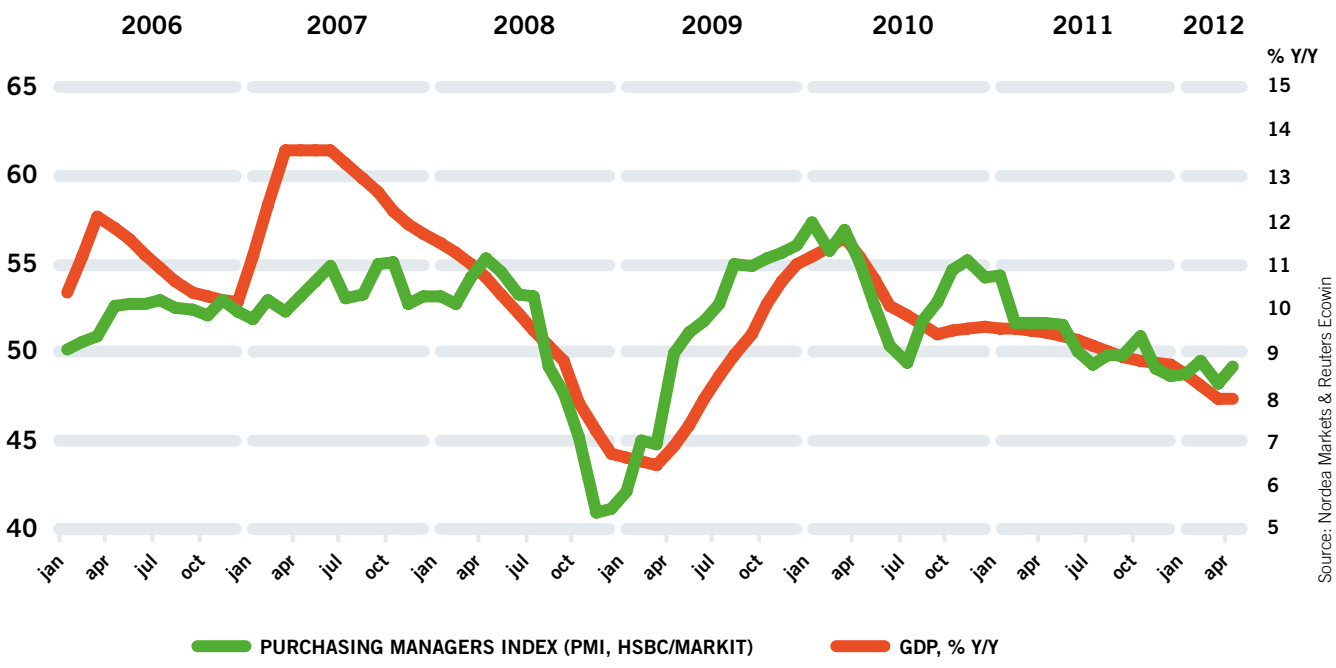
The lower growth level we are seeing in China is due not only to global problems, but also to a slowdown in government investments as well as efforts to stabilize the rise in housing costs. In the current situation, the authorities are adopting another approach than that applied during the 2008–09 finance crisis. China's economy did better than that of most other nations, due mainly to government support in the form of new investment projects and an easing of monetary policy, e.g. lower interest rates and capital reserve requirements. The largest and most important banks are owned by the state and provided loans to investors, particularly to state-owned companies.

In the last six months, however, the state hasn't reacted in the same way. Instead it has applied a somewhat different strategy, concentrating on attaining balanced growth in GDP without investment and inflation bubbles. It appears that they are satisfied with a growth rate of 8% in exchange for a balanced economy."

How important is domestic demand for China's economy today?

"When exports have slowed down, we have to date seen

CHINA'S ECONOMIC GROWTH



Growth in the Chinese economy has slowed during the past year, but stabilised at 8.0 – 8.5%

public investments kicking in as an auxiliary engine for the economy. If we compare the situation prior to the 2008 finance crisis, exports, measured as a percentage of GDP, had fallen by approximately 10% to 25-30%. Furthermore, since China's public finances are in a far better condition than those of the United States and European countries, the state doesn't need to save. Government savings in many other countries are otherwise significantly hampering growth. But as I say, China has to date opted to avoid an expansive approach this year.

In its latest five-year plan, adopted in 2011, the Communist Party expressed the hope that private domestic consumption would play a more important role, but this hasn't happened yet despite the rise in incomes. Development is relatively slow. This is partly linked to higher housing prices, but above all, to a total lack of a social safety net, with people having to save money to cover basic needs such as medical care, pensions etc, which they do, despite the very low rates for savings."

What then are China's plans for the future?

"They are looking very much at opening up and reforming the capital markets. As I mentioned earlier, I believe China will allow the currency to float freely, free up the credit markets, reduce state influence in the bank sector and more. They also want to find new growth strategies that take into account a population that will start to diminish, with China probably having to meet growing competition from cheaper manufacturing countries. Supporting private consumption will constitute yet another major challenge for the economy. Major reforms are going to be needed in China in the years to come, something the new generation of leaders due to be appointed this autumn are expected to address.

In the longer term, there is a 30-year plan that the World Bank and China have drawn up. Among other things, it looks at the role of the state and private sector and emphasizes the need of a shift more towards the private sector and of supporting innovation, research and development, green investments as a growth option, promoting equality and social security, shoring up government finances long term, as well as China's integration with the international markets."

What is happening on the political front? Will China become a democracy?

"The process leading up to the changes in the Communist Party and state leadership, scheduled for the autumn, is proceeding relatively smoothly. The major figures in the new generation of leaders are said to have themselves been involved in planning the latest five-year plan and developments will probably continue in accordance with that plan. One difference here, is that the new leadership cadre appears to be better educated and more internationally oriented than earlier generations. This should contribute to speeding up the internationalization of the markets in China.

On the question of a possible Democratization process, it is hard to say what will happen with any certainty. But the most likely scenario is a very slow move from today's combination of a centrally controlled Communist state and market economy towards greater democracy. Democracy usually becomes an issue for people when the standard of living rises, but developments rarely happen fast and China is a vast country, which makes it difficult for people to stage

any organized and effective protests.

The fact that the State is now trying to do something about spiralling housing prices can be seen as a result of growing demands from the population. If incomes rise too slowly, more and more people will call for changes, which could then lead to a more democratic society."

What about the rule of law as applied in China? How much of a problem is corruption?

"Here we should make the distinction between those living within Chinese society and foreign companies and investors. Foreign companies are indeed affected by corruption and a flawed judicial system, but these are problems that exist in all emerging markets. Relatively speaking, China is a welcoming country for foreign companies. The World Bank's Business Index, which ranks 183 countries according to these issues, places China 91st in the rankings, which compares favourably against Russia listed at 120th, Brazil 126th and India in132nd place."

Information gives you the power to change

HANS STÅHL
CEO NCAB GROUP

The world today is undergoing rapid change and it seems that the waves marking cyclical fluctuations are becoming shorter and sharper. 2009 was, for example, a crisis year, during which production fell by about 20%, before bouncing back with a 30% rise just 1 year later. Today Europe is in the midst of a new crisis. When we look back at what was the norm 20 years ago, economic crisis in those days lasted two years and occurred again every 10 years or so.

Economic cycles seem to have definitely become more transient. Those of us working within the manufacturing industry will need to respond more smartly to those rapid fluctuations and plan our production capacity carefully and appropriately. We have to fully grasp these cycles and be more proactive.

Our business concept has enabled us to effectively handle market shifts over time. Through our factories, we have significant production capacity at our disposal which can be scaled up instantaneously. If we were to use, for example just 30% of our main factory's capacity today, that adds up to an annual production of €250 million.

As much as 95% of all the PCBs that NCAB produce today are manufactured in China, an economy that is growing extremely rapidly. We are seeing today both the beginnings of a move by some manufacturing plants away from the core manufacturing region of south east China and the way the financial structure is rapidly changing with regard to income, taxation and other aspects. It is extremely important that we understand these changes in order to be able to make the strong business decisions, for example, our sourcing strategy for new factories.

NCAB is also taking all necessary measures to ensure it is up-to-date with changing taxation and environmental laws as well as other legislation, - essential if we are to continue offering our customers the best possible, long-term solutions and terms. A number of partners and businesses support us with information. One of those sources is, of course, our bank. We are happy to have an opportunity to share some of this information with you and hope that you will find our interview with Nordea Bank's China specialist, Annika Lindblad, interesting and informative.

Looking to the future: Western Europe

– great prospects for a smart electronics industry

As suppliers of key components to the electronics industry, it is extremely important to understand where this sector is heading. This, of course, applies to technical developments, the way suppliers in the industry interact with each other, as well as where and how development and manufacturing takes place. To try and answer some of these questions, this issue of “In Focus” has turned to two interesting names within the Nordic Electronics market: Mikael Joki, Managing Director of Eskilstuna Elektronipartner and on the board of the Swedish Electronics Trade Association, as well as Mats Andersson, Sales Director at Data Respons.

Mikael Joki has gained a wealth of experience, both in his role on the board of the Swedish Electronics Trade Association and as Managing Director of the EMS company, Eskilstuna Elektronikpartner. Here, he shares his thoughts on the future of the electronics Industry.

If we could start by looking at the history, how would you describe what subcontractors (EMS companies) have done to improve their offerings to meet the product owners' (ODM companies) demands?

"In general, they've broadened their range of services, with specialised services and a focus on specific segments. The EMS companies have tried to create niches for themselves in, for example high reliability electronics or medical technology. We are seeing a focus on the low and medium volume segments, although they also seek to win some of the larger volume projects to fully utilize their manufacturing capacity. Some EMS companies are also turning to Lean Production in order to further improve their production process flow."

"I can't, however, emphasise enough how important it is to strengthen the link between design and production."

MIKAEL JOKI, MANAGING DIRECTOR, ESKILSTUNA ELEKTRONIKPARTNER

"The EMS companies are turning to specialisation in order to be able to take on greater responsibility and therefore, higher value added business. They are looking to serve more as consultants, supporting in the development of concepts and products. An important factor for success in the future is the ability to participate more fully in the development of processes linked to production technology, enabling EMS players to make the move from simply manufacturing suppliers to partners."

What sort of relationship would you like to see between the supplier and product owner?

"I'd like to see them work jointly across a broad platform and take in the entire value chain when introducing a product to the market, as well as set up a common goal right from the start. Ideally, we would see the product

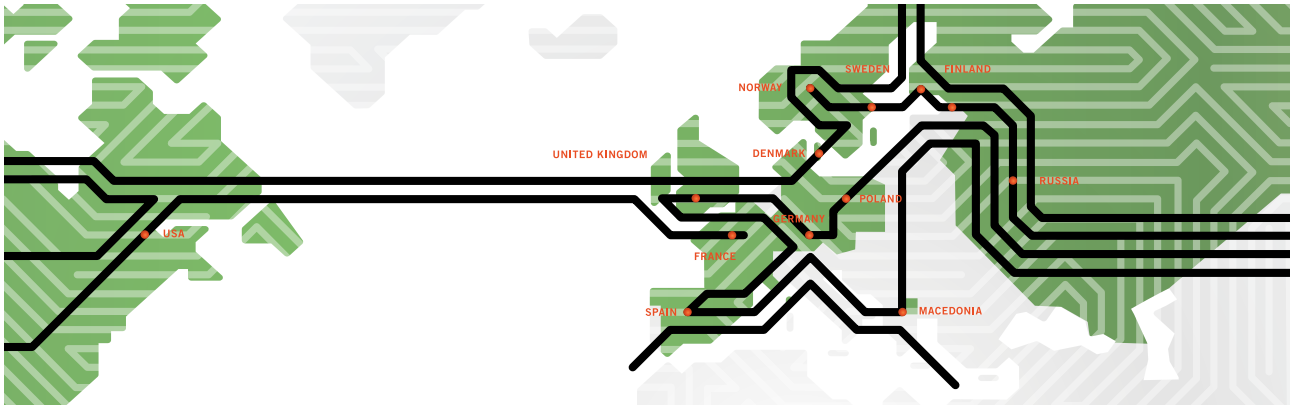
Mikael Joki would like to see EMS companies become more involved in the design of the end product.

owners taking their ideas to the manufacturers, after which they would together choose appropriate partners to design and develop a production prototype. All too often, we see mistakes made at the design phase, which leads to an exaggerated focus on minimising costs at the production stage."

"Gathering round the same table would enable us to create smart designs built on a well defined goal. This approach would also make a locally based value chain competitive. But first I think we need to see a change in attitude that opens the way for manufacturers to participate and encourages them to contribute their know-how. It is all very well to talk about design for manufacturing but how many parties are actually involved in the entire chain?"

To what extent are EMS companies involved in the design of the final product today?

"Too little. Most manufacturers can experience production problems that can be traced back to the early phases of the design process. These can often be related to P-FMEA (Process Failure Mode and Effects analysis) requirements without sufficient D-FMEA (Design Failure Mode and Effects Analysis) having been carried out, both well proven tools to aid quicker transition from design to production. Alternatively, it might also be found that components that worked at the prototype stage, are not necessarily suited for higher volume production, designers failing to grasp the link between footprints and soldering points that don't meet



"The Baltic countries, Poland and Rumania are still currently outsourcing markets, apart from the large Asian market." says Mikael Joki.

IPC norms, or possibly, ambiguity or even poorly specified requirements relating to the PCB or other critical components."

"The work of the designer is crucial in this context. They need to familiarise themselves more with the production process. They have to leave their desks and adopt a more hands on approach close to the manufacturer in product development. This will give you the right quality and provide the product owner with a better platform from which to achieve competitiveness."

What do you think the future holds in store for the Industry?
"We are going to have to meet even greater demands if we want to continue as suppliers in the future. It won't be enough to deliver the right product on time, with the right quality, at the right price and in some cases, extended payment terms. We'll have to accept greater responsibility for the final product even though we don't own the product. That will, on the other hand, give us a larger chunk of the business, as well as enable us to put greater demands in respect of design solutions."

"Apart from better interaction within the value chain, I also hope we will see more collaboration between companies, for example through benchmarking, which can help build up the electronics market overall. That's what we at the Swedish Electronics Trade Association are striving for - a strong platform for collaboration that enables problems and prospects for the Industry as a whole to be brought to the fore. My impression is that the other Scandinavian countries, as well as Germany, are better at this. We should learn from them."

How would you describe the outsourcing trend and what do you think will happen in the future?
"Taking to one side the large Asian outsource model, the Baltic countries, Poland and Rumania are still currently considered as potential outsourcing markets. We continue to see a trend where manufacturing today is not automatically being out-sourced to Asia, and in some instances, we are seeing an increasing flow of production trickling back. We now have a future scenario that will see some production relocate back from the Far East, driven by global market forces."

"I think that Scandinavia could well be a part of a global shift with increased production volumes within the electronics industry in Europe. Our region offers the advantage of a stable market. Just now, the infected relations between China and Japan reveal the inherent instability in Asia. And with incomes rising fast in the low-cost countries, the balance will eventually shift."

So you feel the prospects of Scandinavia being competitive in the future of good?
"If we set our sights right for our own operation and with the appropriate value chain, I think that we will be able to build a strong competitive concept that measures up to our customers requirements and expectations. Our production is highly flexible and needs only small tweaks to be able to adapt to unique or specific demands. The increasing complexity of the products manufactured today speaks volumes about the production capabilityhere, as well as the trend towards smaller production runs. This puts greater demands on both man and machine. We have the industrial experience, as well as systems that encourage individuals to experiment and develop in their job situations."

"Poor quality is expensive and that message is more readily acceptable today than it was 10 years ago." says Mats Andersson.

"I can't, however, emphasise enough how important it is to strengthen the link between design and production. The value chain will greatly benefit from this and attract new competence. What is also needed is competence development and research, both basic and applied re-search. This is something that we at the Swedish Electronics Trade Association are working to create a common strategy for."

Finally, how would you describe your dream supplier?
"That would be a pro active supplier who always delivers the right quality, at the right time, as well as ideas as to how we might generate better business together."

PROFITABILITY THROUGH LONG-TERM COLLABORATION

In his role as Sales Director at Data Respons, **Mats Andersson** has a multidimensional view of the market, since his company provides both consultancy services, develops system solutions and sells standard products for imbedded computer systems.

How do you view the future of the electronics industry in the Nordic region?
"I am convinced that it is here to stay and will develop. Then there is the question that is always being asked regarding the amount of production that takes place here compared to elsewhere. Research and development will be conducted in Sweden and the Nordic region. Production will also be located here, the question being what type and what sort of volumes."

"The largest volumes for the consumer market will surely continue to be produced wherever costs are at their lowest, but I think we'll find the Nordic region producing industrial applications, encompassing both small, medium and large volumes."

What are the three most important criteria Data Respons applies when developing your products?
"Innovative strength, speed and quality. We have to be innovative and familiarise ourselves with the customer's

application. Through dialogue with the customer we can find out what they really want. Having thoroughly familiarised ourselves with the technology, we can proceed to find the best solution. Speed is vital and, in order to reduce time to market, it is important to have a long-term and close relationship with our subcontractors."

"A strong relationship and long-term collaboration make it easier to develop the next generation of products."

MATS ANDERSSON, SALES DIRECTOR, DATA RESPONS

"On the question of quality, poor quality is expensive and that message is more readily acceptable today than it was 10 years ago. Industrial customers understand the difference between consumer electronics and the demands of industry. Industrial users have to be able to fully rely on their software always functioning and that the units always contain the same components. There is a greater level of awareness today; they don't just look at price, but also recognize that they get what they pay for. Today one can discuss a product's life-cycle costs at a professional level."

What changes can you see in the way the product owner and subcontractor collaborate? And how do you see things shaping up in the future?

"We are increasingly seeing it take the form of partnerships and long-term relations. They work very closely together in a project during the product's entire working life. That's good because strong relations and long-term collaboration make it easier to develop the next generation of products."

"The parties involved have to work together to achieve a level of performance, quality and price to be able to compete in the global market. As I said, long-term relationships are - for all concerned - the best basis for reducing time to market in the future. New partnerships always take time to establish."

What sort of demands on the value chain will the future bring?

"We will see closer collaboration, but I don't think that there will be any dramatic changes. One aspect that will be looked at more carefully will be to avoid unnecessary transportation, which is both financially and environmentally beneficial. A close partnership is of course a precondition for achieving this."

What are your thoughts regarding outsourcing trends in the future?

"Right now, we're seeing a levelling out between Western Europe and Asia/Eastern Europe, but I suspect that occurs in waves. Production will always take place wherever the desired balance between price and performance can be achieved. It's also becoming apparent that factors such as language, culture, travel times and time differences are beginning to form part of the equation, which would speak for local production."

"What's important generally is to bring in the question of where and how production is to take place at an early stage, when the product is being designed and developed. One needs to take stock of this early on in the process since it has a bearing on the final result."

"At Data Respons, much of our development work takes place in the Nordic region, close to the customer. We've located more of our production however in Taiwan, which is a leader in embedded products. We have set up an office there in order to secure the projects and quality. We do have production in the Nordic region as well, both at our own facility and at our partners locally. We take care to avoid reinventing the wheel. If we are talking about tailor-made products within demanding applications, there could be advantages in producing locally due to a greater need of crosschecking and monitoring."

What countries will be focusing on development and manufacturing respectively?

"Production will to a large extent take place in the Baltic countries and Asia – China, Taiwan and the Philippines, while R&D will continue to be located here in Europe."

"There are variables to that picture however. Asia used to account purely for production, but they are now building R&D competences there. At the same time, it's important that we retain our manufacturing knowledge base in the Nordic region in order to be able to produce equipment that will work in our environment and our climate. If we don't have any manufacturing activities here, we will no longer be able to create designs that are appropriate in our hemisphere. A lack of engineers is another problem we are going to have to face in the future. The trade organisations are focusing on this issue to ensure that there will be a new generation of engineers."

And how would you describe your dream supplier?

"Speed is vital. We want a high degree of attention. And of course we should always expect quality. We should be provided with the quality we pay for. My dream supplier should also understand and care about what we want and be able to contribute a great deal of knowledge. We want a dialogue where the supplier feels free to make suggestions and advise whether our idea might be implementable in a better way then we had thought ourselves."

Questions around the world: How would you describe the interaction between being PMS provider and PCB supplier in the value chain on your market?

UK

HOWARD GOFF
Managing Director, NCAB Group UK

"The trend we see is very much towards a collaborative solution between the OEM/ODM and their EMS provider and the PCB supplier. The benefits of this are evident to all. The OEM/ODM gets design support to achieve optimum production price, the EMS company has confidence that the PCB supply chain is secure and proven and the PCB company has the opportunity of producing "right" board in terms of design and cost."

FINLAND

KIM FAGERSTRÖM
Managing Director, NCAB Group Finland

"In Finland and the Baltics, the size of the end-customer is a decisive factor in this context. The biggest end-customers strive to control the whole process and assume full responsibility for the design as well as prototyping. They often also define the certified PCB suppliers they wish to use and their factories. The smaller the end-customer, the more freedom they give to their EMS company to choose the suppliers and manufacturers and then rely on their control of the whole supply chain."

POLAND

MICHAL KOPCEWICZ
Managing Director, NCAB Group Poland

"From my perspective I see a strong connection between the end-customer and EMS supplier. They are very good at communicating their sales needs, which both parties benefit from. However, there is still an issue with regard to technical problems, with the EMS suppliers reluctant to consult the end-customer, preferring to turn to the component suppliers for help in solving them. I feel we would all benefit from a more open attitude."

What do we know about the future

HANS STÅHL
CEO, NCAB GROUP

The overriding vision behind the NCAB group's operations builds on the needs of our customers – in this context mainly the EMS companies. However, we live in an ever changing world when we consider our customers' requirements. In order to adapt to tomorrow's demands, it becomes more important, as far as possible, to find out how our customers – and their customers in turn – view the future.

That is the background to our interviews with Mats Andersson and Mikael Joki. Notwithstanding the fact that they are both involved in the north European market, their view of the future is highly relevant in a far broader context, since our experience tells us that events in northern Europe reflect those in other western markets as a whole. NCAB's own success around the world is evidence of that.

You only need to look 10 years back in time to see how much has been happening in the electronics market. The biggest change during that period has been a shift in production to Asia. The process of change within our industry is still happening and will continue into the future and those who fail to adapt will not survive. We need to accept that part of the production will continue to take place in low-cost countries. In the high-cost countries, we will to a large extent focus on smaller volume production runs, with high focus on R&D as well as work with accelerated time to market demands on new product development.

To retain our competitive position, as a supplier we need to build on the way we communicate so that we together, starting at the design stage, "build in" all the knowledge that we jointly possess. In today's market, we cannot afford, nor do we have time, to make mistakes.

Prototype manufacturing

– quality and lead times have top priority

Prototypes play a decisive role on the road from the drawing board to finished PCB. We asked Mark Tomba, in charge of PCB purchases at Stoneridge Electronics, to describe their approach with regard to PCB prototyping and what is important for them. He strongly underlines the importance of quality and short lead times.

Stoneridge Electronics are OEM manufacturers and suppliers of electronic components, modules and systems to the automotive industry, mainly for heavy goods vehicles and other commercial vehicles. Among other things, they manufacture dashboards with displays, digital tachographs, telematics systems and electronic control units. They deliver to customers worldwide, including such manufacturing giants as Scania, Volvo, MAN and Daimler.

Mark Tomba is based in Estonia and, as Commodity Manager for PCBs, he is in charge of purchasing PCBs from

Mark Tomba is in charge of purchasing PCBs from suppliers worldwide for all three of Stoneridge Electronics' manufacturing units, in Estonia, Sweden and Mexico.

suppliers worldwide for all three of Stoneridge Electronics' manufacturing facilities in Estonia, Sweden and Mexico. In total, some eight million US dollars worth of PCBs are supplied to these facilities annually. "That figure is increasing, due both to bigger volumes and to the fact that the PCBs we use in our products are becoming increasingly sophisticated, which means the unit price is higher." Mark explains.

When it comes to customer relationships, the biggest challenge perhaps for Stoneridge Electronics, is to establish the right combination of quality, technical solutions and cost. When developing new products, one cannot just apply the latest technology; in a competitive situation, price is always a factor. In Mark Tomba's words, "We need to be able to provide customers with the appropriate technology at a reasonable price level".

Since the automotive industry uses extremely sophisticated products that require a high level of know-how, the tendency is to build long-term partnerships with subcontractors. Quality is always a priority for Stoneridge's customers and as the degree of complexity is always increasing, it is vital to keep pace with developments.

– Our end products are complex electronic units and their complexity increases with every generation. This affects all our subcontractors and not least PCBs manufacturers. Says Mark Tomba, adding that while six-layer ENIG boards may be the norm today, he foresees that the next few years will bring a demand for PCBs with HDI solutions.

PROTOTYPES - CRITICAL FACTORS

PCB prototypes play a crucial role in the development of the products Stoneridge Electronics manufacture. Initial prototypes are produced in order to check the PCB Stoneridge have designed. This is often done in close cooperation with the supplier. At this first stage, the prototypes are evaluated and design changes can be incorporated to improve and refine the final solution. "We would then a need second batch of prototypes at very short notice. The time factor is critical here. The new prototypes are evaluated and we fine-tune the design further before ordering a third batch. We would expect that batch to be more or less the finished item, essentially ready to be put into production. Our schedule is particularly tight at that stage, so it is vital that our PCB suppliers are professional, flexible and able to handle that final hectic phase of the process". Says Mark Tomba.

– Accessibility is also very important, as we need quick responses to our queries.

MARK TOMBA, COMMODITY MANAGER, STONERIDGE ELECTRONICS

Lead times are crucial, since the entire validation process has to be handled as efficiently as possible and, more often than not, the further you have come in the process, the less time you have left. Quality of the prototypes is another crucial factor. The whole point of creating prototypes is to enable you to test and evaluate your design, so it's a matter of being confident in the knowledge that any possible defects in the prototype originate from the design rather than the quality of the PCB itself. "What we demand first and foremost from our prototype suppliers is quality". Mark Tomba underlines. "It doesn't matter if they supply on time, if their quality isn't up to Stoneridge standard".

Yet another important factor is the ability of the supplier to provide technical support and be accessible locally, while also being able to supply products to a global market

– We also expect our PCB suppliers to possess some basic knowledge of the automotive industry, maintain reasonable price levels and be financially stable; essential in that

once we have selected a supplier, we want both parties to view this as a long-term relationship. Says Mark Tomba and adds "Accessibility is also very important, as we need quick responses to our queries. And last but not least, we value good personal relationships. Ultimately, it's people who do business, not companies".

CAN CHOOSE BOTH EUROPE AND ASIA

During the past few years, the NCAB group has started delivering prototypes to Stoneridge Electronics. A major plus factor here is that NCAB can offer production of prototypes both in Europe and Asia. "We can opt for the solution that works best from case to case. Local manufacturing is the most flexible alternative if time is an issue, while Asian manufacturers are better from a commercial perspective. We use the latter option if we can wait a week or two. However, we place most of our orders in Europe, since time is often such a decisive factor". Says Mark Tomba and adds, "If I could ask one thing from NCAB, that would perhaps above all be for more competitively priced European manufactured PCBs".

– We bring our PCB suppliers into the design phase at an early stage. As they are the experts, this saves time both with regard to the design itself as well as later, when the PCBs go into serial production.

MARK TOMBA, COMMODITY MANAGER, STONERIDGE ELECTRONICS

Another advantage that Mark Tomba points to is the ability of NCABs prototype producers to take on serial production of the PCBs. This is an advantage at the transition stage from prototype to sampling, ie, the final phase of developing a PCB, when the serial volume manufacturer produces samples of the finished PCB. "Of course," says Mark, "players in our industry sector can separate the process of prototype production from that of volume manufacturing, since we have a reasonable time span between the two. However, the transfer of know-how between the two phases is still important and NCAB has an advantage on that point".

Mark Tomba has worked at Stoneridge Electronics for 12 years and has seen how manufacturing trends have changed during that time. One particular difference is that customers are today expecting global solutions that work in all geographical markets. The solutions themselves are also highly sophisticated and incorporate such features as advanced displays, GSM and GPS. "Lean production is another trend on the manufacturing side, where the focus is on minimising waste with regard to time and designs within production. We strive for maximum production efficiency, and that's why" Mark says "we bring our PCB suppliers into the design phase at an early stage. As they are the experts, this saves time both with regard to the design itself as well as later, when the PCBs go into serial production". Concludes Mark Tomba.

CRUCIAL FACTORS IN PROTOTYPE MANUFACTURING

Mark Tomba lists the five most important factors when choosing prototype producers (in order of priority):

1. **Quality**
2. **Lead times**
3. **Technical support**
4. **Global solutions, local presence**
5. **Long-term partnerships**

STONERIDGE ELECTRONICS IN BRIEF

- Form part of these Stoneridge Group which supplies electrical and electronic components, modules and systems to the automotive industry.
- Have an annual turnover of US$210 million.
- Deliver exclusively to the automotive industry, mainly solutions for heavy goods vehicles.
- 100% OEM manufacturer.
- Produce, among other things, dashboards with displays, digital tachometers, telematics systems and electronic control units.
- Have customers worldwide, among them, Scania, Volvo, MAN and Daimler.
- Have factories in Estonia, Sweden and Mexico.
- Purchase PCBs to a total value of $8 million yearly.
- Purchase PCB prototypes to a value of $150,000 - $200,000 yearly.

Questions around the world: How would you compare regional prototype manufacturers with their Asian counterparts?

SWEDEN

LUDVIG LINDQVIST

KAM at NCAB Group Sweden

– We always try to find out as much as possible about the customer's requirements in order to work out the most appropriate lead times for their prototype project. In Europe we can deliver within 24 hours, which Asia cannot match today. However, in Asia we can quickly shift from prototype to volume production. We often need as little as three days, since both the prototypes and volume items are produced at the same factory. This also enables us to better monitor the transition to volume production.

UNITED KINGDOM

RYAN PELLOW

KAM at NCAB Group UK

– Eastern Europe can still be trusted, especially during holiday periods such as the Chinese New Year. Since customers focus on total lowest cost, Asia is still the primary destination for their prototype production. However, NCAB can offer a seamless transfer between Europe and China, which for example, would assure the customer of an uninterrupted process, even during holiday periods. It is this type of teamwork that enables us to reduce our customers' time to market.

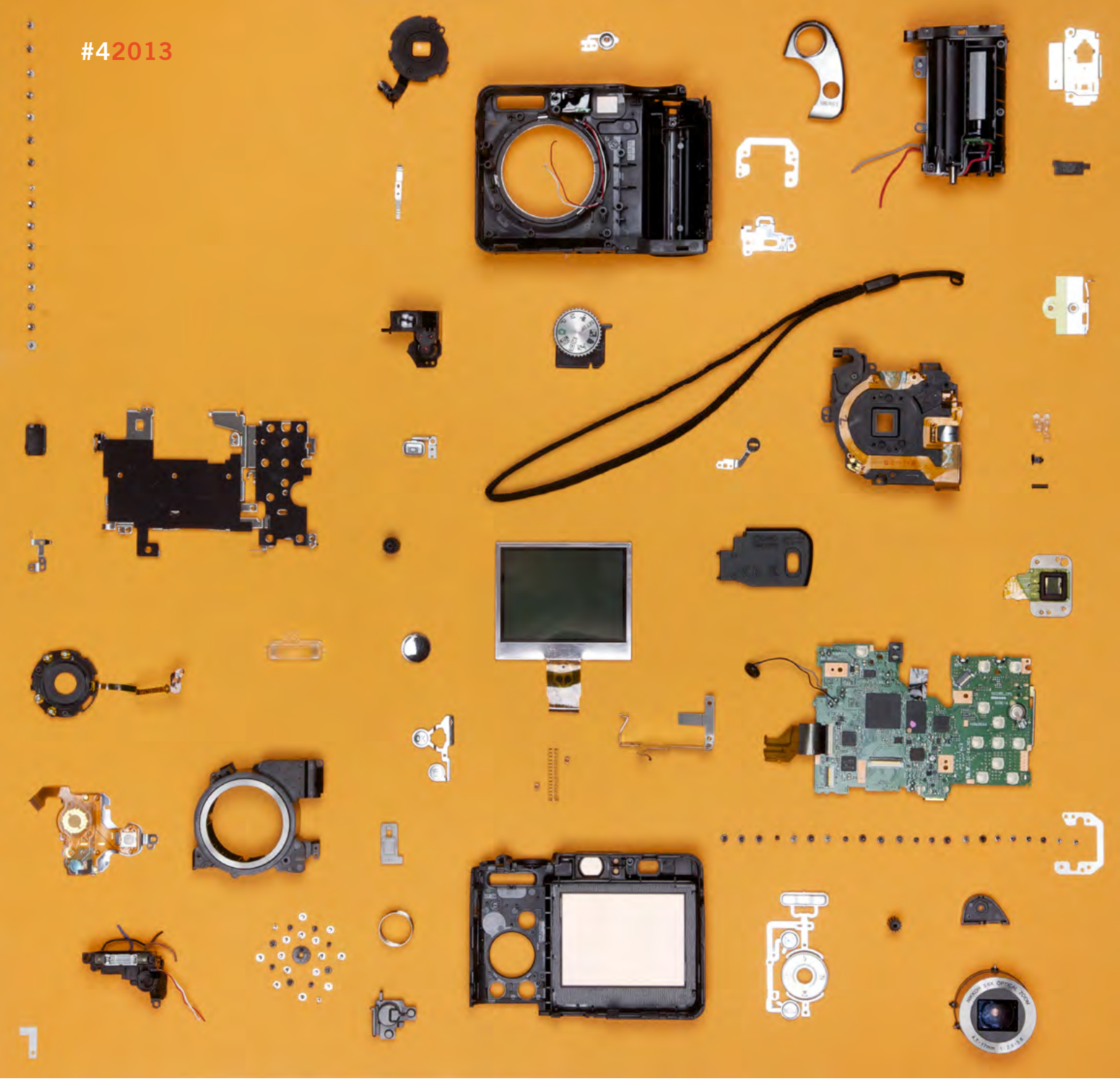
Right prototype reduce the time-to-market

HANS STÅHL
CEO NCAB GROUP

Prototypes constitute by far one of the most important tools available that enable a producer to shorten their product's time to market and reduce total production costs. PCBs are to be found in more or less all technological products today and, as a result, prototypes are key to insuring a properly functioning end product. It is thus high time we shift our habit of focusing on lead times and instead, start focusing on quality and producibility.

Customers are becoming aware of the benefits and value of prototypes that meet a range of requirements. Where perhaps historically, a local manufacturer, due to lead-times, might have been used for basic verification and testing, today, prototypes are in effect becoming increasingly used as a means of verifying both the manufacturing process, as well as driving cost-saving designs. This approach enables PCB volume manufacturers to participate actively in the process and lend their technical expertise to the design work, ensure specifications are achieved and that the design requirements can be duplicated in serial production. This approach enables PCB volume manufacturers to participate actively in the process and lend their technical expertise to the design work, ensure specifications are achieved and that the design requirements can be duplicated in serial production.

With this development in mind, the NCAB Group is turning much of its attention to developing our prototype offering and to providing customers with the most "effective" prototypes from an all-round perspective. More and more customers appreciate this approach and I am convinced that this is a model for the future.



The Components Industry

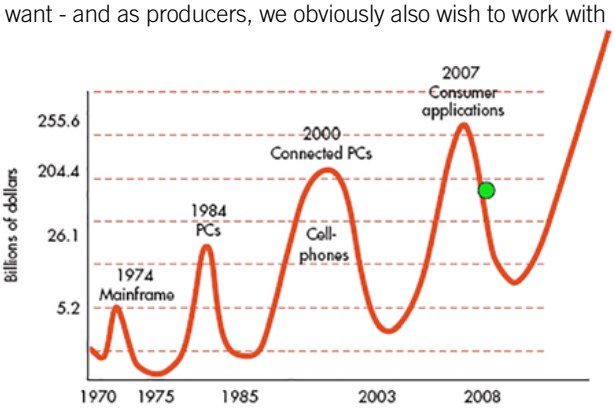
– dictated by customer needs

Developments within the components industry are of course of crucial importance for the PCB industry, but they also have implications for the future of the Electronics industry as a whole. In order to get a picture of how developments in the components industry is progressing, we turned to Anders Pettersson, Technical Marketing Manager at ST Microelectronics, a global leader in the semiconductor market.

How would you describe developments within the components industry over the past 20 years?
"If we look at the situation historically, the industry went through a long period of extreme highs and lows caused by fluctuating supply and demand conditions. Different, individual trendsetting applications such as TVs, DVDs and mobile phones had an incredible impact for periods of time. Rocketing demand created bottlenecks, which led to a surplus of stocks at the end of that cycle, which in turn led to a remarkable price situation."

"The fluctuations during the past 10 years haven't been quite so marked since there is now a really wide variety of applications that influence the market. There are today, applications such as smart phones and tablets; but alongside them we find fantastic things happening within electronic measuring devices, gaming consoles, and the automotive and other heavy industry sectors. There are thousands of industrial applications that also function as driving factors. These different sectors don't have the same cycles, which evens out the peaks and troughs. One could sum it all up by saying that the industry has matured."

What factors steer and drive the development of new electronics products?
"Today increasingly, it's the mass market that's the main driver. Generally, it's the customers who steer the development of new products. We can try to influence what our customers want - and as producers, we obviously also wish to work with



From a historical perspective, the electronics industry has to a large degree been driven by a small number of individual applications, which led to major fluctuations in demand.

emerging technologies. However, I'd go so far as to say that 90% of our behaviour is steered by customer feedback. In order to position ourselves appropriately on the market, we are constantly having to look at what products or functionality we need to develop within a 3-4 year time span."

"Sometimes customers think they can't influence things, but their feedback is a vital contributing factor for our development. It is the customers' needs that prompt us to develop new components or functions combined with working to achieve cost savings and ultimately, lower prices to the end user. Since both involve a considerable amount of investment, we don't take any chances and want to make absolutely sure that we can meet our customers demands."

Where is the trend taking us today?
"With microcontrollers, there are two main directives : low-cost and high-performance, critical when considering the transition from the 8-bit market to a 32-bit market. This shift has happened incredibly fast. In the low end segment, volume is the driver."

"In the high-end segment, we're approaching clock rates of 200 MHz. It is becoming increasingly difficult to differentiate between the microcontroller market and the market for microprocessors. Many microprocessor customers are going to start looking at microcontrollers as possible alternatives. They are, among other things, considerably less power hungry."

"Sometimes customers think they can't influence things, but their feedback is a vital contributing factor for our development. "

ANDERS PETTERSSON,
TECHNICAL MARKETING MANAGER,
ST MICROELECTRONICS

What does the future have in store for components?
"On the digital side, the drive will continue to be along the path of miniaturisation. This will lead to more integration, with more and more functionality incorporated on the silicone. We are always looking to see how much more we can integrate so as to cut the customers' total costs as much as possible. Clock generators, peripherals and analogue to digital converters are already built in and my question is, what is the next item that is common enough to be incorporated into the silicone in the next-generation of microcontrollers?"

What are the implications of miniaturisation?
"As more and more items are being integrated into the chip, the challenge of internal wire bonding, which cannot be easily miniaturised becomes a factor. The microscopic geometries applied in production will lead to higher initial costs for the chip, although the silicon itself will be cheaper. The implications here are that we'll become more dependent on larger volumes."

"For the customer, this may require a change of attitude towards components. The smaller the size of the silicon, the lower its marginal cost and as a result, packaging processes and logistics will become all the more relevant in the final total cost."

Do you see any risks with the way the technology is developing?
"As far as our customers are concerned, we encourage them to work with us to develop solutions that serve best, their market aspirations, their end customer expectations and also, consider the challenges we face. The culture of simply selecting on price alone becomes a risk when considering total costs and the brand damage that can occur if for example, unreliable components and products are launched into the market place."

"The solution is to use recognized component manufacturers whose routines include solving any possible quality issues before they cause any serious damage. When you build in more and more functionality, it is vital you also focus on building in reliability at the design stage. At ST we recycle as

many peripheries and building blocks as possible into our new designs. We also build more and more redundancy into the silicon. To reduce our initial costs, we strive to produce new designs that work as well as possible right from the start."

How would you describe your collaboration with the rest of the manufacturing chain?
"We are working a great deal with our end customer as well as major EMS companies, given that they are likely to be the companies who purchase the components for production. With regard to PCB supplies, we need to work on issues relating to miniaturisation and packaging. It makes sense that we establish a good platform for collaboration along the entire chain. Our end customers in particular would benefit greatly by getting everyone involved and not putting all the responsibility on the EMS companies. That would for example improve their delivery precision to their own customers."

What challenges is the PCB Industry having to face due to developments on the technology front?
"On the consumer side, we're seeing a focus on smaller packaging types, which will require more layers in the boards. The challenge here will thus be the high level of integration, to maintain stocks of PCBs for very small package types, while remaining profitable."

"If a customer is looking for low energy use at a low-cost, choosing the right PCB is crucial. Interestingly, we are seeing antennas for different radio applications being increasingly incorporated into new designs. This definitely offers the PCB industry an opportunity to contribute value through its competence."

What about the assembly industry?
"As far as the assembly industry is concerned, reliability is the biggest challenge. The EMS companies have to be able to deliver quality even with small packaging types."

ST MICROELECTRONICS IN BRIEF

- One of the biggest semiconductor manufacturers in the world who supply components to many different segments of the electronics industry.
- Originally founded as a French-Italian company.
- Corporate headquarters in Geneva Switzerland.
- Listed on the New York Stock Exchange, Euronext in Paris, as well as Borsa Italiana in Milan.
- Turnover 2012: US$8.49 billion.
- About 48,000 employees in 35 countries, 11,500 of which engaged in R&D.
- Manufacturing facilities in 12 locations in Europe and Asia.

Questions around the world: What demands is the PCB industry facing as a result of the rapid technology advancements?

USA
KATHY NARGI-TOTH
Technical Director,
NCAB Group USA

"These rapid developments have created a demand for innovation and investment. To achieve success, companies need to be proactive, and make investments that improve both people skills and advance technology, with new equipment and techniques. To become a leading PCB provider, they'll have to focus on continuous improvement activities that enhance manufacturing flexibility and responsiveness. Being involved at the design phase is one of the best ways to meet the customers' requirements."

FRANCE
CHRIS NUTTALL
Group Quality/Technical Manager,
NCAB Group France

"The industry faces a constant challenge with new learning curves as part of a constantly changing electronics landscape. We have seen this with miniaturization and we will see this again with 3D printed circuit structures. Design guidelines and quality standards have to evolve as technology develops. Materials, processes and factories will need to keep pace for long-term survival. Knowledge is power– so the faster we 'learn', the better the outcome."

SWEDEN
RIKARD WALLIN
Managing Director,
NCAB Group Sweden

"We need to, among other things, handle basic and advanced technology in parallel with our customers. To maintain flexibility, it's vital PCB producers have full control of all their processes. Both the producer and buyer need to have the skills and knowledge to recognize the core factors in each individual project. Among the tougher challenges we are facing is the need to establish a good dialogue with both our direct customers and end customers, so as to avoid any misunderstandings during the business process."

Knowledge and training make all the difference

What impact is the rapid technical evolution within electronics having on the PCB industry and how should customers and suppliers handle the changing scenarios. We put this and other related questions to Bo Andersson, Technical Manager at NCAB Group.

How would you describe developments within the PCB industry during the past 20 years?
"If we go back 20 years, surface mount technology was a new and challenging technique. Since then, developments have been driven by the increasingly small transistors. Today you can fit in more and more functionality on the same surface area. This has enabled increasingly complex boards to be designed - incorporating, for example micro vias, more layers, copper-filled micro via holes and HDI technology."

"We're also seeing far stricter demands being placed on designs that also have to adhere to recommendations. Customers are also demanding better reliability, in fact, having to troubleshoot or repair electronic products is looked upon as a thing of the past today. Everything in the industry moves much faster, with automisation having come so far that any faults that do occur tend to be system-related. The PCB industry has developed strongly during this period, from small manufacturing units who tried to "do everything", to larger players with their own specialities. That's why it's important to make sure that a factory is able to fulfil its designated task."

What effects are the rapid technological developments having on the PCB industry?
"Compared to components, for example, PCBs differ in so far as they are produced for specific customers and applications, in smaller quantities and under conditions that are difficult to control. The more complex they become, as a result for example of miniaturisation, increasing layer count or working with leadless components, the more demanding the manufacturing process will become. There are risks attached. The challenge will always be to improve the manufacturing process. By further automating the process and introducing so-called clean room facilities to create a dust and dirt free environment, you can reduce the risks and be appropriately equipped to handle miniaturisation."

"As I said, the faults that occur are often systemic, which makes it crucial to be able to control the factories you assign the work to. You need to put a lot of time and effort into finding manufacturing partners whose processes are proven and robust. The advances in technology make it increasingly important to choose the right manufacturer who can offer production that can be adapted for different applications. And we should also remember that large scale production is a specialised activity today."

What do PCB suppliers need to do to keep pace with developments?
"It is above all a matter of training and building up your skills and knowledge. We need to interact very closely with our manufacturing partners and monitor their progress. That, as well as follow up and help them to build up their skills, knowledge, processes and equipment. I also think it's important to collaborate with the assembly industry. There are synergy advantages to be gained here with regard to design and assembly blueprints for example. As PCB suppliers, we need to learn from, as well as build up an understanding for, our customers."

Bo Andersson, Technical Manager, NCAB Group

In what ways can the PCB industry develop its links with the assembly and components industry.
"The price of the PCBs can be set at an early stage of the design and development process. The PCB and assembly industries have a great deal to gain by making use of appropriate design skills and thereby produce boards that are optimised for manufacturing. PCB manufacturers can help EMS companies to make substantial savings by helping them to choose the right designs. Choosing appropriate components is also part of this process."

"With regard to the components industry, generally, it is a large-scale and highly consolidated sector and produces components for all kinds of applications. PCB suppliers can't influence developments that much, but it is important they stay abreast of them. Both industries should be aware of each other's limitations. It is difficult to forecast the future, but we'll probably see different types of hybrids appearing, such as components built into the PCBs."

And what is the best approach for customers to adopt in this scenario?
"Here again, it's basically a matter of building up your skills and knowledge and collaborating closely with your suppliers. Awareness and training is what makes the difference and can give you a better total cost."

#32014

High-tech PCBs

– make the right choice from design to volume production

Modern electronic products are expected to offer more and more advanced functions, while the products themselves are becoming smaller and smaller. This puts greater demands on the PCB design and also the aspects relating to the PCB manufacturing process. There are two key factors for the successful production of high quality advanced PCBs; firstly, making the right choices at the design stage – and then carefully choosing the factory that can support the specific technical demands of the project in question.

A horizontal plating line used for copper filling of micro vias on HDI product.

We are seeing an increasing number of electronic functions being squeezed into smaller and smaller products. Whether it's consumer electronics, computers, automotive or medical technology, the overall trend is reduction in size. Not just through a reduction in actual or finished product size, but also as the components themselves are becoming smaller, so the assemblies have to be more densely packed and using smaller features.

Chris Nuttall, Chief Operating Officer at NCAB Group takes up mobile phones as an example:

"Just consider the way they have evolved. A modern phone is not just a phone, it's a smartphone – it's so much thinner, lighter and smaller than the mobiles we had 20 years ago, but in terms of what it can do, it is light years more advanced than its predecessors. As a consequence, the PCBs inside are having to accommodate more and more functions making the design itself much more complex, and all of this on smaller and smaller circuit boards. Let's take an example of a product fitted with NCAB's PCBs, a Hasselblad camera. Take the Hasselblad H1D, which was released in 2002, and could deliver images with resolutions of up to 22 megapixels. The images produced by Hasselblad's latest model, the H5D, can have resolutions of up to 200 megapixels. The sensors, memory and processors at the core of this new and vastly more advanced technology obviously demands a much more complex PCB at its heart.

Chris Nuttall, Chief Operations Officer, NCAB Group.

"Just consider the way they have evolved. A modern phone is not just a phone, it's a smartphone – it's so much thinner, lighter and smaller than the mobiles we had 20 years ago, but in terms of what it can do, it is light years more advanced than its predecessors. As a result, the PCBs inside are having to accommodate more and more functions, making the design itself much more complex, and all of this on smaller and smaller circuit boards."

CHRIS NUTTALL, CHIEF OPERATIONS OFFICER, NCAB GROUP

The onset of these increasingly sophisticated electronic products, has led to more advanced PCBs becoming more commonplace.

The specifications here require so-called HDIs, or High Density Interconnect solutions with greater number of layers, more connections both on the surface and inside the PCB, utilising finer conductor widths and narrower spaces between them, all leading to the design that is based upon smaller, laser-drilled microvias (blind vias), since normal through hole vias simply wouldn't fit into the space available. Therefore we are seeing manufacturers producing more boards that also incorporate buried vias. All of which increases the number of interconnections within the board and frees up valuable space on the outer layer for more components to be placed.

The increased number of layers, together with the micro via technology also requires the use of thinner prepegs and cores than in conventionally manufactured boards which also leads to increased demands upon the factories.

MORE PRODUCTION STAGES

"Widespread miniaturisation is putting far greater demands on the production equipment at the PCB factories. Many of the stages in the production of HDI boards *are* similar to those used for the manufacture of conventional boards. However, HDI production calls for considerably more sophisticated equipment in order to achieve the tiny geometries that are required." Says Kenneth Jonsson, Technical Manager at NCAB Group Sweden.

"And not only does incorporating several layers of buried vias and/or micro vias into the boards require a number of additional steps, but these also need to be repeated several times and all of that increases the degree of complexity and the risk of error." He says. "All the geometries are much smaller on HDI boards, which calls for better dedicated equipment designed for high-tech manufacturing. Many factories do have laser drills, but there aren't, unfortunately, as many who also possess the appropriate plating equipment and processing experience to enable them to actually make good-quality, reliable HDI boards. That's why NCAB puts a great deal of time and effort into qualifying and verifying a factory before giving it our seal of approval to manufacture HDI boards for our customers.

"The first consideration in generating micro vias is that of advanced laser drills that can drill blind holes, down to 50µm, although most micro vias normally have a diameter of around 100µm. The latest generations of these machines are capable of drilling up to 500 holes a second." Says Kenneth Jonsson.

A Laser Direct Imaging (LDI) machine transfers and prints the pattern directly onto the circuit board material by means of laser beams.

Following on from that, the transferring of the circuit pattern onto an HDI board is an equally critical operation that calls for the highest precision, which the traditional photography based techniques can't achieve. Instead, HDI board makers either use CCD camera aligned imaging machines with parallel lighting, or Laser Direct Imaging (LDI) systems, which images the pattern directly onto the bonded

Kenneth Jonsson, Technical Manager, NCAB Group Sweden.

photo-imagable material. This makes for improved quality as no photo tool film is used thus enabling a much greater accuracy of transfer of pattern features down to 50µm.

THE RIGHT EQUIPMENT AND CLEAN ROOMS ARE PREREQUISITES

"To ensure the best possible result in the imaging transfer process, it's vital that it's performed in special clean rooms with carefully controlled temperature and humidity levels." Explains Kenneth Jonsson.

The clean rooms that have been used for these processes meet the US FED STD 209E 10,000 class. This class has constituted the industry standard for many years now and stipulates that the concentration of airborne particles ≥0,5µm (a human hair is typically 20 – 50µm thick) in size should not exceed 10,000 particles per cubic foot.

"Today the best factories have clean rooms that meet the class 1,000 requirements. To give another idea of what this means; the air in our normal everyday environment contains 1 million particles, of the same size, per cubic feet. However, good quality clean rooms are expensive, both to buy and to properly maintain." He states.

"Widespread miniaturisation is also putting far greater demands on the production equipment at the PCB factories and calls for considerably more sophisticated equipment in order to achieve the tiny geometries that are required."

KENNETH JONSSON, TECHNICAL MANAGER, NCAB GROUP SWEDEN

Producing HDI boards also requires a different type of plating line. For non-HDI boards one can usually make do with ordinary plating lines, with vertically held panels that use mechanical and air agitation, allowing you to get the plating chemicals to facilitate good copper plating onto the surfaces and into the holes (the through hole part of the plating requires good solution flow within the holes or you will not obtain a reliable or uniform plating thickness). However this method isn't really suitable for HDI boards with blind holes that can measure 100 µm or less in diameter. That's why most factories use both horizontal plating lines as well

as Vertical Continuous Plating, VCP lines. These methods involve spraying the plating chemicals onto the pads under high pressure, which ensures that the micro vias are properly plated.

Positioning the solder mask correctly against the pattern poses a significant challenge, since extreme components, for example 01005 and µBGA circuits with 400µ or finer pitches have to provide registration down to 37µm, or in extreme cases, 25µm. To achieve this, CCD exposure units are required.

"PCB makers now have the possibility to use special LDI units to exposure the soldermask, as the soldermask manufacturers have developed special soldermask inks, to support HDI designs, that require lower energy to polymerize." Says Kenneth.

LOOKING 'UNDER THE BONNET'

Chris Nuttall explains that the NCAB Group has to carry out a thorough examination of all aspects of a factory's production processes and equipment when assessing whether or not it meets the demands for high-tech manufacturing. As he puts it, it's like looking under the bonnet and servicing the car before buying it.

Horizontal desmear and PTH line.

"If a factory says that it has laser drills, and is therefore capable of producing reliable high-tech PCBs, it's rather like saying that all you need to do in order to become a new Michelangelo is to get yourself a hammer and chisel. We know that laser drilling equipment is not the start and finish when it comes to HDI production - it's equally as important to have the right kind of plating equipment, to have the right chemistry as well as knowing how to handle, control and verify the full plating process. We also look at what kind of chemicals and methods they're using, image transfer equipment and procedures and this is in conjunction with understanding the numbers behind the factories real experience in this field and their performance – both of which are crucial factors." He says.

"But we are looking for our factories to specialise in manufacturing advanced boards – it has to be a key part of their core activity." Adds Kenneth Jonsson.

Currently there are 11 different factories, across China and Europe, which are able to manufacture HDI PCBs for NCAB's customers.

"We listen and talk to our customers, we work to understand the detail of their designs and their requirements. We find the right factory for each specific project, depending on its complexity, volumes and any other specific demands. And our strategy to ensure that we maintain and develop a best in class and secure factory base, continues within this field of technology as we always have more than one approved source that can support NCAB and our customers." Continues Chris Nuttall.

All this certainly rings true according to one of NCAB's customers:

"The highest quality and delivery capability are decisive factors for us. And NCAB Group's flora of carefully selected factories ensures that the capacity is always there and they are able to meet the different delivery times and supply the variety of PCBs we need. Thanks to their efficient quality control measures "on the spot " in China, NCAB's factories always deliver what they promise. NGAB Group is a flexible and secure partner." Says Mikael Borg, Purchasing Manager at Hasselblad.

Kenneth Jonsson emphasizes the importance of the factory being able to not only manufacture advanced PCBs, but also in keeping the number of production errors to a minimum.

"Take HDI boards as an example. Producing this type of board according to the 3-4b-3 method involves laminating, drilling and plating it four times. If they return a 10% rate of failure during each round in the factory, the number of boards they would end up scrapping would exceed the volumes they actually deliver. In such a case you need to question the quality of the items that make it through to the delivery stage." Says Kenneth Jonsson, adding that this should be a cause for concern: "When you consider that the components on the board can cost more than 100 times the board itself, it's imperative you can rely on the quality of the board. Otherwise, it can be incredibly expensive, if you're forced to scrap the product at a later stage."

GET THE DESIGN RIGHT FROM THE START

Yet another aspect you need to prioritise with advanced boards is the design itself. The margins are tiny with regard to such factors as conductor widths, isolation distances between copper features, impedence requirements, hole sizes and their relation to capture and target lands. All this poses a considerable challenge at the layout stage. The design rules should be realistic and adapted to volume production right from the start. Kenneth Jonsson warns of a number of pitfalls when only considering prototype factory design rules: "One example may be making the inner layer

cores too thin so as to produce a good capacitive coupling. It might work in a prototype factory, where great care is taken to basically hand-process these thin inner layer cores. However it could lead to major problems when the product is in volume production, since they may have different capabilities and in this instance the thinner cores may easily get stuck during the processing through long, volume oriented etching lines since they are basically too flimsy. We thus recommend that one avoids, if possible, inner layer cores that are thinner than 75 µm as our experience tells us that this 'design guideline' works well across our higher technology factory base."

"If a factory says it has laser drills and is thus capable of producing high-tech PCBs, it's rather like saying that all you need to do to become a new Michelangelo is to get yourself a hammer and chisel. It's just as important to know how to handle the plating process as to have cutting-edge plating equipment."

CHRIS NUTTALL, CHIEF OPERATIONS OFFICER, NCAB GROUP

If there's enough space on the board and the component is available with different pitches, Kenneth also recommends to select a component with a larger pitch since it reduces the complexity of the board and saves costs.

"Smaller components may be less expensive to purchase or more readily available, but this approach might render the board unnecessarily expensive in relation to its end application. Opting for small components, usually, increases the complexity of the circuitry, and therefore the board will increase in cost also.

This is where the customer should work with NCAB to determine if the design needed for such components is a cost effective one – is the reduced cost associated with buying more readily available, but more complex, components balanced with a potentially more expensive PCB? If, for example, it is to be used in mobile phones destined for the consumer market, or in low volume production.

We are also seeing more PoP (Package on Package) type components being used in the industry. You should carefully check whether the assembly house is familiar with the technology and the extra costs it might involve. Of course, smaller components are space saving, which could produce a cheaper board, as long as it doesn't mean making it more complex, with several levels of micro vias or adding buried structures etc. One invariably has to weigh up the space contra complexity issues at the design phase.

The laser drill is used in HDI production.

"NCAB makes a point of being involved right at the very start in order to help customers find the right solution. One has to realise that there are real differences between producing prototypes and volume production." Explains Kenneth Jonsson. "If you focus on the wrong things from the start, it could jeopardise the entire project if you find that your design can't be applied in volume production. My recommendation is to initiate a 'seamless project' together with us at an early stage; in order to ensure that the board can be manufactured at a reasonable cost with the right level of complexity for the design and also for reliable yields." He continues.

"The advantages of turning to NCAB Group is that we possess the skills and knowledge both on the design and manufacturing sides. We know what the factories need in order to successfully deliver quality products, within realistic leadtimes. We know which factories are best at fulfilling different types of requirements. And we also know how to design boards that will give customers high yields and best in class quality end products." Concludes Chris Nuttall.

"8 design tips for HDI"

COMMON DESIGN PROBLEMS REGARDING HDI	PRODUCTION PROBLEMS DEPENDING ON THIS	BEST SOLUTION
Dielectric too thick for laser vias	Increased time for laser drilling, lower productivity. High risk for voids in the plating process, especially in the bottom of the microvias. Increased price for the PCBs due to reduced yields.	Use an aspect ratio under 0.8:1.
Too small microvia size	Increased risk for the microvia to be blocked by unknown material and therefore won´t be plated satisfactorily. High risk for poor plating of the microvia, especially in the bottom. Increased price for the PCBs due to reduced yields.	Use microvias of 100 µm with an aspect ratio under 0.8:1 for microvias intended for copper filling. Use microvias of 125 µm and with an aspect ratio under 0.8:1 for microvias where copper filling is not a requirement.
Too tight geometries in the form of too small capture and target lands for the microvia	If the target land is too small, the risk will increase for partly missing it (so called overshoot), and material adjacent to the pad will be burnt down to the next layer. If the capture land is to small, it is a risk for the land to be broken, which is not acceptable to any class in IPC-6016.	If possible, use a start pad that is 200 µm larger than the microvia. If possible, use a stop pad that is 200 µm larger than the microvia. At tighter geometries consult NCAB.
Too tight demands on permitted dimple on copper filled microvias	Increased price for the PCBs due to reduced yields.	Place the requirement of dimple to a maximum of 25 µm.
Too tight demands on the thickness of overplating of plugged vias. (POFV or VIPPO)	Affects the flow of the process, at a reasonable thickness of the overplating all the vias can be drilled in the same operation, which makes the process much easier. If the overplating is too thick this will reduce the possibilities to produce outer layers with thin tracks/small isolation.	Set the requirements according to IPC-6012 class II and demand only ≥ 6 µm as overplating thickness.
Epoxy via plugging demands for too many different sizes of vias, this applies to both buried as for through vias	Hard to control that bubbles don´t occur in the final plug, and that there won´t be a problem with complete filling.	Only one size of the plugged vias are preferred, if more sizes have to be plugged, keep them within a range of 0.15mm.
Microvia placement	If microvias are placed directly into SMD surfaces, unnecessarily voids can arise in the solder joints at reflow soldering. The price structure increases if the micro vias are copperfilled.	Pull the microvias from the SMD surfaces if possible. If there is no place to do alternative 1, place the microvias right into the pad and demand for them to be copperfilled.
Too small distance between the staggered holes and the microvias – microvias or microvias – buried vias	If the staggered microvias are placed too close to each other, there is a risk that the overlaying hole can intrude on the underlying one with bad plating as a consequence. This can be solved by copper filling of underlying microvias or overplating if buried vias, all this means increased cost and risk.	Regarding microvia-microvia, keep a distance of 0.30 mm between holes if possible, if not, go down to 0.25 mm. Example: 0,10 mm microvia and 0,25 mm buried hole gives 0,475 mm and 0.425mm in center to center distance.

Questions around the world: What developments are you seeing on your market, specifically with regard to high-tech PCBs? How would you describe your customer's expectations and demands on PCB manufacturers within this area?

RUSSIA

VLADIMIR MAKAROV
Managing Director, NCAB Group Russia

– For a long time, ordinary double-sided PCBs were the norm on the Russian market. In recent years however, the situation has changed markedly. It isn't really surprising, since the market has been heading towards miniaturisation and increased functionality in electronics products, which calls for more advanced, denser boards. Achieving the qualities the market is looking for in PCBs is a challenge mainly for skilled designers. The key has been to work closely with our customers to help them develop more modern and competitive products.

MACEDONIA

SLOBODAN SHOKOSKI
Managing Director, NCAB Group Macedonia

– The economic recovery in the Balkans is gathering momentum, although it's still somewhat uneven. The main drivers are the advanced economies, such as Slovenia, while progress is slower than expected in other areas. Over 60% of our orders are for high-tech PCBs, most of them from contractors in the telecom industry, where quality and reliability is a priority. Our biggest challenge is that we need to put a great deal of time into meeting the exact needs of our customers.

GERMANY

OKTAY CAN
Key Account Manager, NCAB Group Germany

– Our customers are leaders within the high-tech segment, who demand increasingly complex solutions, both in terms of applications and technology. The biggest growth in demand that we are seeing is thus for more complex PCBs – at the very limits of what is possible to achieve. At the same time, customers are demanding more with regard to quality, reliability and lower costs. It takes time to develop the appropriate competence in order to manufacture such advanced boards, and therefore it's important we take great care in choosing appropriate suppliers. Our business builds on our ability to meet the high demands our customers place and deliver quality they can rely on, at the right price.

Skills and collaboration are prerequisites for a sustainable product

HANS STÅHL
CEO NCAB GROUP

The main article in this issue of In Focus looks at the many questions that can arise with regard to HDI boards. There is a great difference between an HDI board and a simple double sided PCB. The differences are apparent all the way from the initial design stage right through to manufacturing and purchasing. As the article points out, a factory's equipment is just one part of the production process. The skill and knowledge of its staff are just as important. However, one shouldn't avoid embarking on the HDI road, since the technology offers so many advantages, including above all, the ability to meet the market's demands for miniaturisation and reliability. It is vital that designers and buyers choose the right partner on this journey, a partner with the technical experience and grasp of both prototype and a volume production. This, to avoid the pitfall of designing a board that works well at the prototype phase, but not when it comes to volume production. It is also important to have several factories that are well established in the industry, so that we can always deliver the optimal solution, irrespective of the volumes involved.

However, the most important factor behind achieving an optimal design is make sure you work together with all the parties involved, i.e. the OEM companies, CAD designers, EMS companies and PCB manufacturers. All too often, when we receive an enquiry from our EMS customers, we find ourselves presented with a finished design and no time to make any improvements. There is a lot of time and money to be saved by implementing the right approach - most importantly you'll get a product that will last for decades!

Sustainable business

– a winning formula for the future

By taking a firm and comprehensive grip on its sustainability work, the NCAB Group is declaring its intention to assume responsibility for the social and environmental consequences of its operations. It also encompasses a desire to hand over a healthy world to future generations, but NCAB's management also maintains that it is good for business.

"Sustainable business involves building up one's operations in a way that combines successful business with social and environmental responsibility."

ANNA LOTHSSON, STRATEGIC PURCHASING MANAGER, NCAB GROUP

In the autumn of 2013, NCAB decided to invest seriously in its sustainability work. "Sustainable business involves building up one's operations in a way that combines successful business with social and environmental responsibility. It's a prerequisite for survival in the longer term." says Anna Lothsson, Strategic Purchasing Manager at NCAB and the person in charge of the group's sustainability work.

Caring about environmental and social sustainability alongside the financial aspects is not new to NCAB. The company certified its management system according to ISO 14001 in 2003 and applies the same certification in its work with its factories. In 2009, a code of conduct was introduced that applies both to the NCAB Group and its factories. This was followed up in 2011, when the CSR (Corporate Social Responsibility) factory audits started to be implemented; these audits monitoring onsite that the code of conduct was being applied and fulfilled. "Now we have, at management and board level, decided to shape an approach where we can handle sustainability as a whole and not on a case by case basis. We want this to permeate every aspect of the company's activities." says Anna Lothsson.

STEADILY INCREASING MARKET DEMANDS

NCAB Group Chairman and co-owner, Christian Salamon, explains that it is of course easy to feel motivated from a personal perspective to take part in sustainability efforts towards achieving global sustainability, but points out that such efforts are also appropriate from a purely business perspective.

"From the end-user to manufacturers, the market is putting increasingly higher demands on the way products are made. It is therefore encouraging to see that on this issue, ethics and business go hand in hand. So, by delivering quality products that our customers can stand behind in terms of social and environmental sustainability, NCAB is building a competitive advantage for themselves," he says and continues: "We are a world leader when it comes to the products and services we deliver and we're also taking leadership in sustainability. We are well positioned to do that, given our size and position within the industry. Some customers make no secret that they want to see us take the lead on the sustainability front, while others, at this time, are merely expressing appreciation and interest in how we are tackling the issue. Whatever way you look at it, by focusing on it now, we make sure we are one step ahead."

NCAB Group CEO Hans Ståhl is at one with this: "We are the first off the starting block among enterprises of our size and calibre.

"We are a world leader when it comes to the products and services we deliver and we're also going to be a leader with regard to sustainability."

CHRISTIAN SALAMON, CHAIRMAN OF THE BOARD, NCAB GROUP

I'd say this could give us what I'd describe as 'time monopoly'. Clearly, sustainability is an area that's really in touch with the times and can generate a great deal of market appeal. When we are out describing what we are doing to customers, there is no mistaking their interest. Moreover, broadening our horizons this way and taking a greener agenda on board is a real challenge. The sustainability factor is also very important for the company as a recruiting tool and a way of attracting the best people." Hans says.

ENVIRONMENT ON THE AGENDA SINCE A LONG TIME BACK

The environmental aspect is vital, given that PCB manufacturing involves processes which utilise large amounts of water, chemicals and minerals. As a result, it is not surprising that the environmental impact of PCB production has been a discussion point for a lengthy period of time.

Hans Ståhl started in this industry back in the early 90s and recalls that even at that time it was important to keep track of emissions. "No customers want to be associated with polluters," he says, and adds: "Chinese regulatory authorities are by no means lax on issues such as these, so to manage this in a good way is absolutely crucial."

Hans Ståhl also emphasizes the importance of transparency: "It is important to talk about what you are doing. Sustainability is not the sort of task that you can say is finished or ever really completed, but it is important to be open about how you are tackling it. That's the only way you can really get things done."

CURRENT FOCUS AREAS FOR NCAB'S SUSTAINABILITY WORK

- Working conditions in factories
- Chemicals in the manufacturing process
- Anti-Corruption
- Employee Satisfaction
- Diversity / Equal opportunities
- Transport / CO2 emissions
- Customer satisfaction and cooperation on issues of sustainability
- Sustainable product development

Christian Salamon mentions another important aspect: "Whether we're talking environmental or social responsibility, we cannot be content with just setting goals. We need to build an effective process to find out how these goals are met, a process that also allows our customers to verify what we do. What we deliver may only be a small building block in their end product, but it's crucial they are completely comfortable with all aspects of that building block. This is not easy to achieve; it requires a good deal of effort and resources, but it is precisely what generates the kind of added value that attracts customers." concludes Christian Salamon.

ISO 26000 AS A FRAMEWORK

NCAB has chosen to transform the rhetoric and ambitions into concrete action by using the ISO 26000 standard, Guidance on Social Responsibility, as a framework. It is not yet possible to be certified under this standard, but in some countries, including Sweden, companies can issue a self-declaration that they will adhere to it. This declaration is then reviewed and approved by a certification body, in NCAB's case, the Technical Research Institute of Sweden (SP). The areas covered by the standard are organizational governance, human rights, labour practices, the environment, fair operating practices, consumer/customer issues, as well as community involvement and development.

"The sustainability factor is also very important for the company as a recruiting tool and a way of attracting the best people."

HANS STÅHL, CEO, NCAB GROUP

"By implementing ISO 26000, we ensure that these issues become a natural part of our daily work and are absorbed into our management system," says Anna Lothsson. "Since we ourselves do not possess all the necessary skills, we have brought in the consulting firm Trossa, who will also help us to produce our first sustainability report."

The consultants have carried out a detailed study of the company and made an assessment of the current situation, in which they have looked at questions such as to what degree NCAB Group is applying the ISO 26000 guidelines and what could be improved and how? The process includes examining the priorities of key stakeholder groups who are in various ways affected by NCAB's operations and who are important to the company's development - customers, factories, owners, employees etc.

"The result of the analysis forms the basis of our sustainability strategy, the objectives and the activities that we have established. It helps us to prioritize and find the right focus for sustainability work, which in turn helps us determine what level of ambition to apply in different areas and the amount and type of resources to be allocated," says Anna Lothsson, also emphasizing that "it's important we don't build our strategy just on what we personally think is right, without knowing why we do what we're doing."

DEMANDS ALREADY BEING MADE

Environmental issues are, as mentioned earlier, important factors in PCB manufacturing. It is satisfying to note that the NCAB Group has already made major contributions towards a resource-efficient and thus less polluting production process. Obviously, less wastage will be one result of the company's strong focus on improving quality and on helping customers to produce a PCB design that is optimized for factory production from the outset.

Another important area of focus with regard to the factories is ensuring good working conditions. NCAB already places demands on the factories they work with, which

NCAB Group values have been developed jointly by all personnel. This simplifies responsibility-taking at all levels and gives us an efficient way of working, we do not need to develop new processes when common routines exist. At the picture Anna Lothsson, NCAB Group, Rikard Wallin, NCAB Group Sweden and Martin Magnusson, NCAB Group.

“By implementing ISO 26000, we ensure that these issues become a natural part of our daily work and are absorbed into our management system.”

ANNA LOTHSSON, STRATEGIC PURCHASING MANAGER, NCAB GROUP

cover both environmental and social responsibility issues. With the emphasis the company is now placing on sustainability, the improvement work in those areas will now be further intensified. This will include a greater focus on those issues in the sourcing process as well as follow-up audits on site in the factories.

Transportation is another important issue to address. Today, PCB consignments from China are almost exclusively transported by air, which produces significant carbon emissions. One of NCAB’s priorities is to be able to better measure and monitor emissions related to transportation and they are, together with customers and transport partners, looking at ways of cutting these emissions.

Two other important areas are combating all forms of corruption, an integral part of NCAB’s Code of Conduct, as well as working towards creating equal opportunities for all, regardless of factors such as gender, ethnicity or age, for example in recruitment. The emphasis for NCAB employees should always be to achieve a good balance between work and personal life.

Anna Lothsson is very happy about the comprehensive approach NCAB is adopting: “It feels good to define clear priorities for our sustainable development in line with our strategy. One thing that is truly great is how well sustainable thinking fits in with our corporate values of ’full responsibility’ . Seeing how it includes social, environmental and ethical responsibility, makes it very attractive.” Anna concludes.

SUSTAINABILITY REPORTING REFLECTS THE CURRENT POSITION

NCAB Group is also producing a sustainability report for 2014, according to the international GRI standard (Global Reporting Initiative). This document reflects the current situation leading up to the upcoming improvements, which readers will be able to monitor year by year in future reports.

“The sustainability report is our way of showing what we have already achieved and where we are heading,” says Anna Lothsson and continues: “The idea is to clearly communicate what we’re working on and why, to customers, factories, other partners and not least, internally. We report our long term goals, measurable objectives and describe NCAB’s challenges and opportunities when it comes to sustainability.”

Hans Ståhl, for his part, is convinced that NCAB’s sustainability work will start bearing fruit sooner rather than later:

“I know that this will benefit our business, as well as that of our customers”. Customers appreciate our efforts and I believe that our investments in this work have already begun to pay off.” Hans concludes.

NCAB GROUP AND SUSTAINABILITY

PRINCIPLES

- Ensure that sustainability initiatives have the support of the board and management, and that they are part of their agenda.
- Dare to take hold of it properly and allocate resources.
- Dare to communicate, both internally and externally, where we stand today, risks and opportunities.
- Integrate sustainability into the business and in decision-making.
- Find a suitable framework to work with (ISO 26000).
- Develop a strategy for guidance and prioritization of sustainability issues built on dialogue with stakeholders.
- Where do we stand today in the focus areas? Start assessing, and setting measurable goals based on the assessed results.
- Engage external expertise if necessary, but own the issue internally.
- Consider what kind of company we want to be. Remember that we want to be attractive to customers, partners and employees.

HISTORY

- Environmental policy since 2002.
- Certified according to ISO 14001 since 2003.
- Work with ISO 14001 certified factories, basic requirements since 2007. Annual monitoring through own audits.
- Adopted a code of conduct for the NCAB Group and our factories in 2009.
- Implemented CSR audits in the factories since 2011.
- Provides design support for optimized manufacturability, which among other things, minimizes material usage and reduces waste in manufacturing.
- Follow the regulations governing ROHS, REACH and conflict-free minerals.
- Communicates about CSR to customers through various channels (seminars, newsletters, websites, blogs).
- Works in accordance with ISO 26000 as of 2014.
- Implements strategies, objectives and activities for sustainable development in 2014.
- First Sustainability Report 2014.

This is what we do. All the time. Thinking, understanding, designing, creating and processing PCBs.
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