
Sharp and Foxconn: What should Foxconn do with Sharp from a displays perspective?

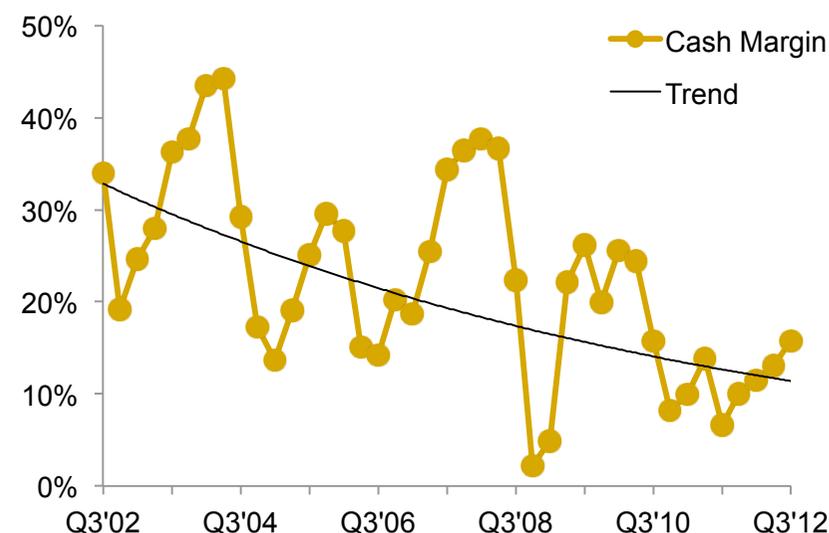
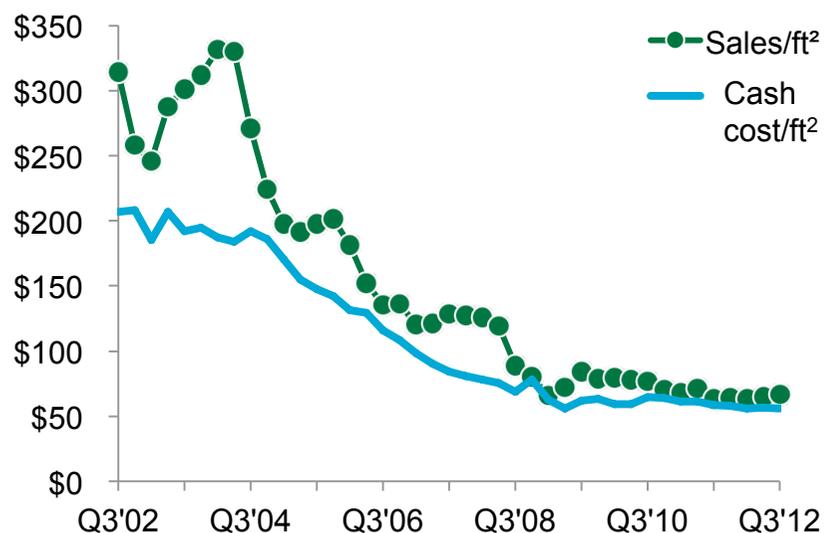
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Agenda

- Sharp and how it got to a liquidity crunch
- Foxconn and why it would benefit from what Sharp brings
- The merger integration plan in our view
- Summary and conclusions

Margin compression in the display industry has been the long term economic trend, here shown for the decade '02-'12:



- Area-based prices have fallen at a 19% compound annual rate for all AMLCD over the last 2 decades.
- Combined AUO+LCD sales fall similarly because they are about one-half of the industry.
- Note that their Cash Cost (Sales-EBITDA) has been falling 2 points slower than their sales for a declining EBITDA margin

- Cash margin/m² for AUO+LGD in USD terms is falling on trend from 34% in Q3'02 to 16% in Q3'12.
- This is a proxy for free cash flow: decreasing returns to scale is evident.

Sharp has put itself into a difficult situation based on a number of poor decisions lasting nearly a decade:

Too little capacity then too much

Flip flopping B2B and B2C strategies

Poorly played bet on IGZO in Kameyama

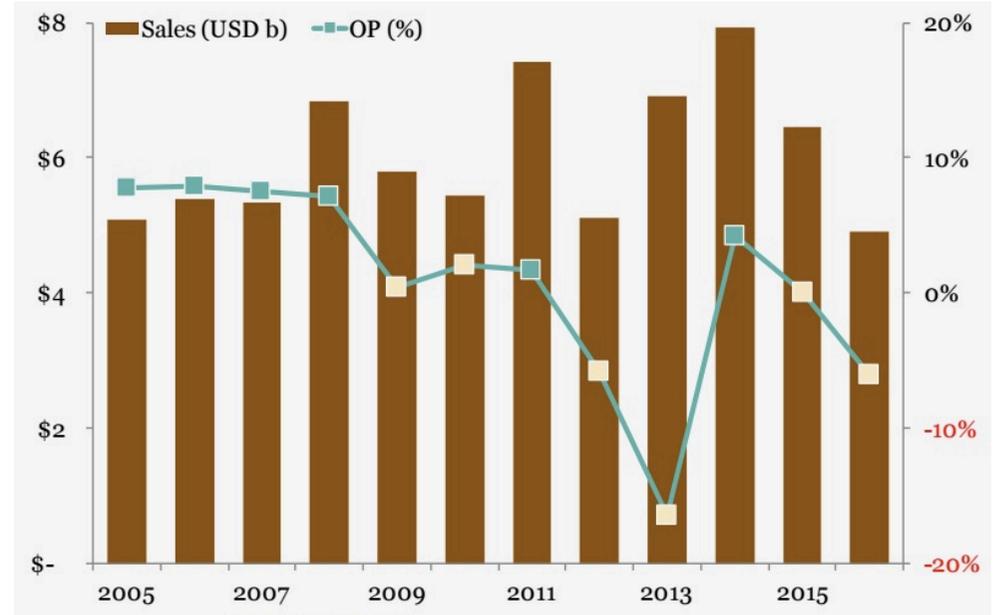
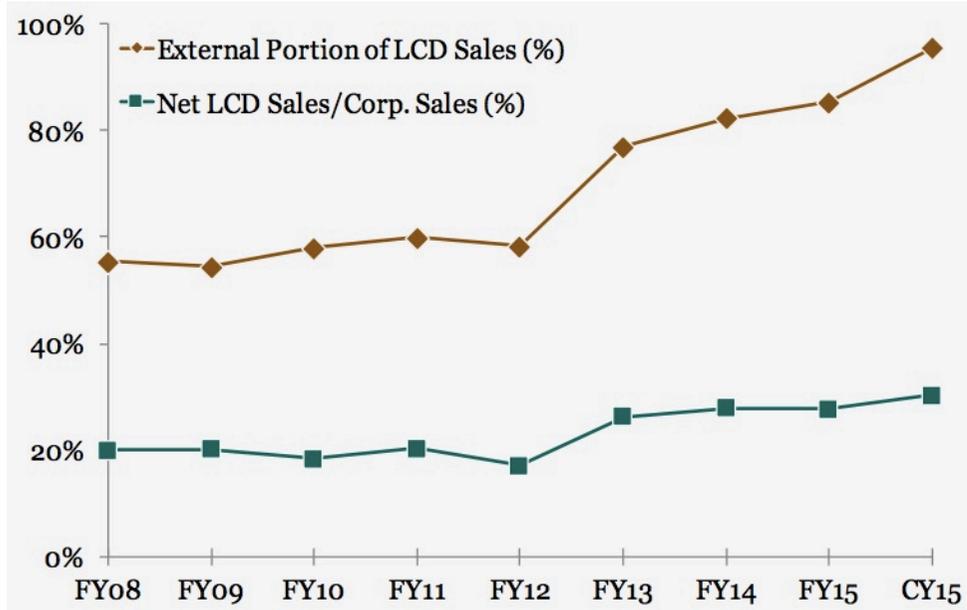
Aggressive bet on solar before all competing bets were placed

Sakai Gen 10 is a misfit fab (reminds us of Hitachi's V2)

Risky strategy to miss the "gap in the middle"

- We can trace back the reasons for Sharp's current financial situation to the early 1990s
 - Late to invest into large panel capacity and then when they did invest into Kameyama (Gen 8) and Sakai (Gen 10) it was too much
- The channel has developed concerns, we hear, over Sharp's strategy changes between branded and B2B sales; they lost trust
- Recent problems stem from to a risky new strategy (we understand the motive but it isolates Sharp further by stopping sales to mid-tier TV and IT markets) and a risky new technology (IGZO) for premium products

Sharp's financials: The more Sharp has had to sell to a merchant, non-Japanese market the lower its financial performance has been (LCD business)

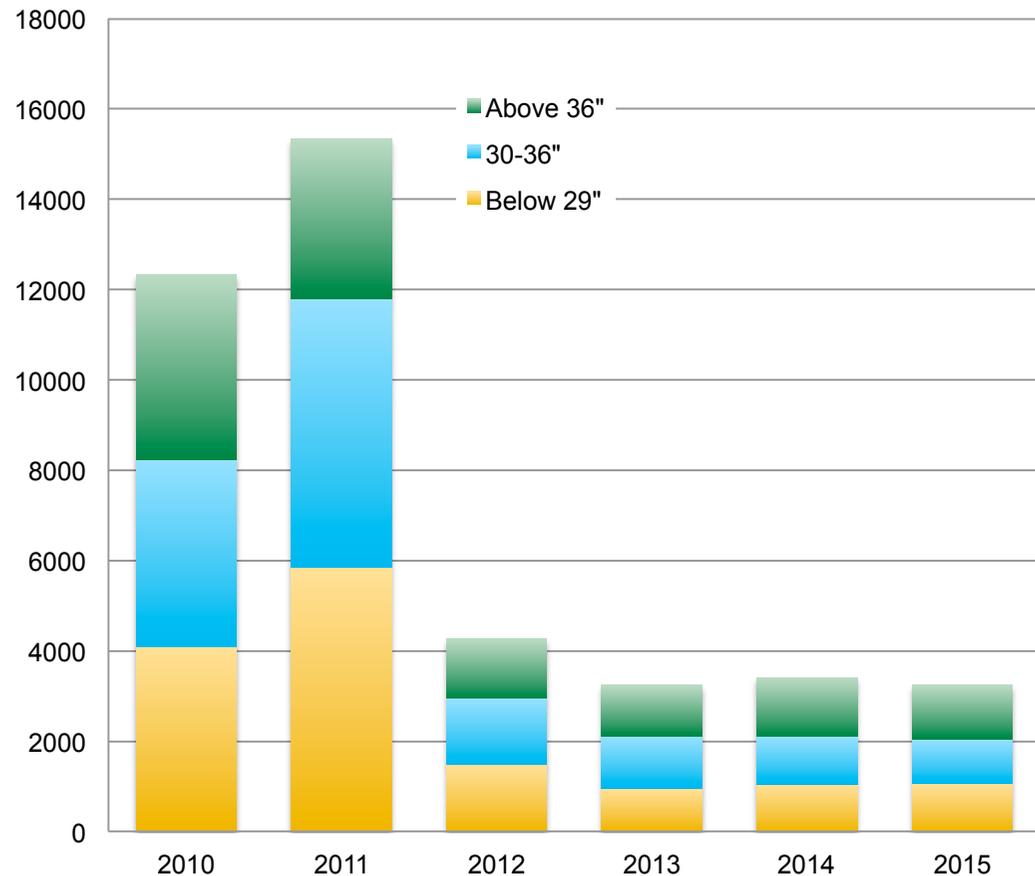


- Sharp has historically done quite well financially with its LCD business especially when the Japanese market was doing well
- However, Sakai was a step too far and as the company had to push further and further into the (Chinese) merchant market then the profitability fell

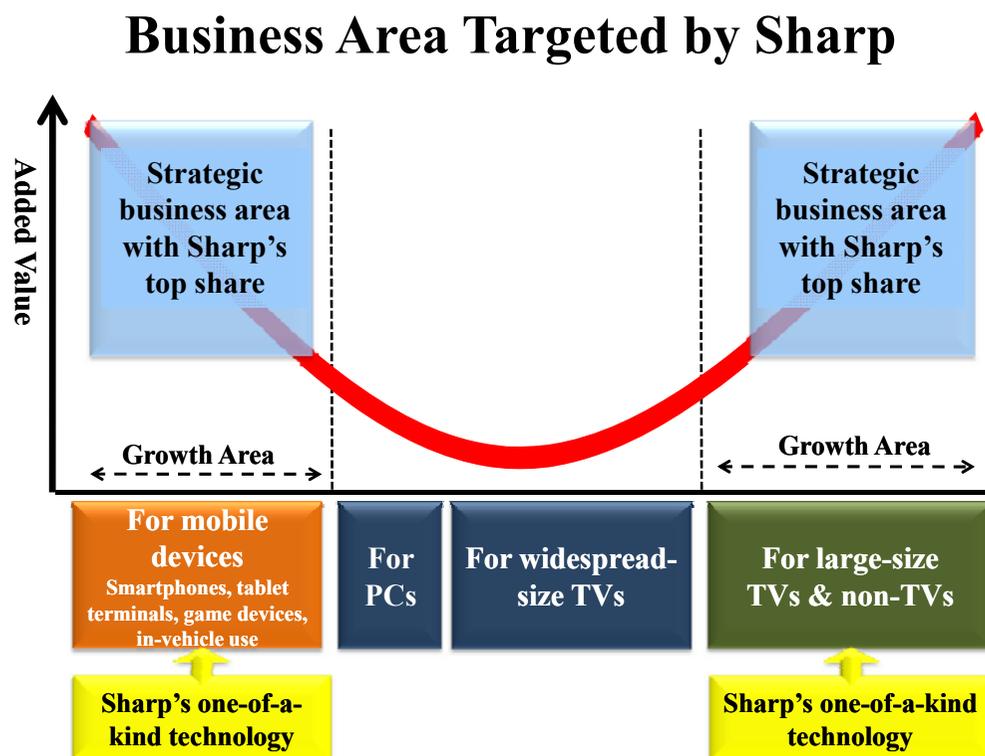
In addition to Sharp-specific problems, Japanese stimulus policies in 2010-2011 pulled-in domestic demand and left demand low after 2012:

Japanese market collapse (TVs k) Domestic shipments (Jan-Aug)

- Japanese stimulus packages from 2009 designed to increase domestic consumption
- One of the provisions was a 5% subsidy on “energy efficient” LCD TVs
- Of course this impacted Panasonic, and Sony also, but Sharp is more reliant on the domestic market
- TV demand has not been the same since



Sharp chose to pursue the risky strategy of giving up the middle ground. New strategy relies on areas where Sharp has know-how, but perhaps not all the requisite IP:



14

- Sharp has predicated its change in strategy on giving up the middle ground in the display industry the mid-tier TVs and IT products
- We agree that the mid-sized (30" to 49") TV business is commoditised and unattractive financially, but it remains important and represents a large portion of total TV screen-area demand
- Sharp aimed to focus on its own CGS (its own brand of LTPS) technology and IGZO technology for mobile devices and IGZO also for 4k2k and higher resolution large panel
- Sharp may well now have learned some valuable lessons about how to make IGZO but quite a bit of the core IP is owned by SEL or JIST
- Turnaround plan of FY15 has Sharp moving back into medium displays: automotive but also notebooks

Sharp's display assets have various liquidities. Some assets be could be sold and moved... others not:

Sakai (SDP)

- Sole Gen 10 in the display industry in 2016 (though BOE constructing one similar) which is bad news because equipment suppliers are supporting a 1-of-a-kind facility
- Moreover the economics of Gen 10 are only beneficial for very large TV, otherwise the larger the substrate the higher the material cost is per m² due to defect density questions
- Sakai is an island "Campus" co-located with colour filter and glass lines (Corning)
- DNP and Toppan operations folded into Sakai (Sharp Display Products)
- Recent problems loading Sakai

Kameyama (Large panel converting to tablets and high performance IT)

- Gen 8 factory in Kameyama
- 2160x2460mm at 80k sheets total that has been transitioned to IGZO.
- Transitioning to IGZO but the transition has not been smooth
- Challenge: converting this much capacity to tablets or other small panels demands large shares of markets competitors seek also
- Kameyama site has LTPS capacity also, up to 20k sheets of Gen 6 capacity and 55k of a-Si. Sharp have commented publicly that this plant (Kameyama 1) is pretty much dedicated to Apple business

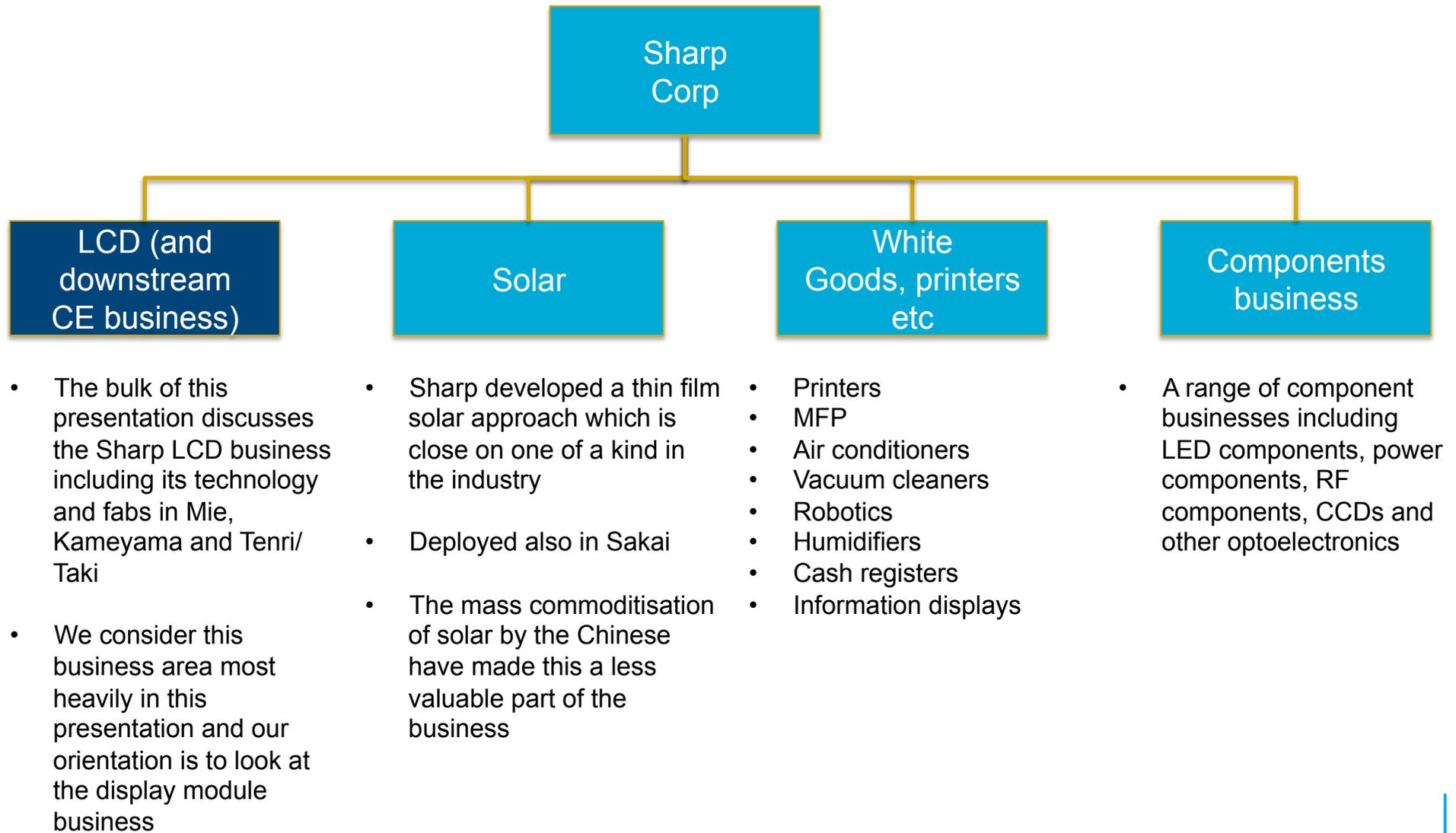
Taki and Tenri plants (Small panel)

- Taki: 95k of LTPS (CGS) in CGS B fab of 730x920mm
- Taki plant 2 phases C and D: 108k per month of 680x880mm
- Tenri CGS A: 15k sheets 620x750mm. This will close at the end of August 2016
- The small panel business has always been one of the stronger parts of Sharp's business with ability to drive specifications and demand premium pricing

What does Sharp have?:

- A reputation as a technology leader in the display industry backed by innovations such as their own metal induced crystallisation process (CGS), for LTPS and collaboration with SEL on IGZO
 - Recent work on CAAC-IGZO is particularly interesting but we hear there are no plans to put this in mass production
 - Sharp is the first to ship IGZO TFT panels but others are developing such ability, also
- A reputation for high technology especially in the small panel business, with a history of setting specifications and achieving high prices
- A mid-tier brand name, unfortunately, as a branded TV supplier
- A “black box” approach to technology development, where Sharp often goes it alone
- Unclear plans for OLED though plenty of work in R&D
- A general marketing positioning around high resolution (4k2k and 8k4k TVs) LCDs that it believes offer a “3D like” real experience without having to be 3D
- A historic relationship with Apple to the degree that Sharp is still considered one of the true technology players to the display industry
- In general the Japanese (unlike the Koreans) have a reputation for building fairly “rigid” factory concepts with less forward-looking upgradability
- Around 50,000 employees in 2016

Sharp's other businesses:



Sharp pretty much needed to find a “Big Daddy” funding partner with access to supply chains in China

- Sharp has seen its capacity share dwindle despite the investments into Kameyama and Sakai
- Really trying to answer the question here of who would benefit most with the Sharp assets (where the value is the engineers and knowhow): its translating these into new fabs in China for someone who can arrange the land, funding and tax breaks that is the important partner. This is a big daddy figure
- Future investment into displays is pretty much in the hands of the Chinese both as the place of future capacity expansion but also in terms of new materials supply chains that might be able to provide some economic relief to the 70% of LCD costs that are the materials
- CSOT has recently been announced in discussions with CPT as an acquisition (a massive HR strategy in our view)
- CEC-Panda might be an obvious candidate given that Sharp has an established technical collaboration with them in Nanjing, and former equipment sales
- Electronics majors like BOE and Huawei might seem to be candidates also
- Hon Hai has come to the top of the list as the most interested party

Potential Big Daddy deals

Hon Hai

CEC (Panda & TPV)

CSOT-TCL

Huawei

BOE

Many different deals have been suggested for Sharp, but the core valuable business is the small/medium displays business:

	Honhai	Intel	HP	BOE	CEC Panda	Apple	Comments
Sakai (Gen 10 TV)							One-of-a-kind white elephant
Kameyama 2 (Tablet, IT)							May be moveable and valuable
Taki and Tenri + Kameyama CGS							May be moveable and valuable

- The small medium business overall has always been the more attractive piece of Sharp
- The Kameyama 2 fab, once transitioned to tablets and IT products based on IGZO might be valuable and relocatable or part of a deal with the Chinese or others
- It is the Sakai Gen 10 fab that is the most difficult story and really only makes sense as a supplier to large panel TV markets for strong brands. CEC-Panda is the only other firm that has been contemplating a Gen 10 and for them, there might be valuable lessons in how to run one

The alternative deal to the one with Foxconn would have been the one with INCJ to merge Sharp with JDI:

	Small panel	Large panel	a-Si	LTPS CGS	Metal oxide	OLED	Quality of fabs	Quality of technology
JDI								
Sharp								

- Sharp-JDI combination would be very strong in small panels (Wonder if the competition authorities may be concerned)
- Technology strength is very high: the reality is while technology can give a profit advantage for a period of time (up to 3 years) it seldom translates to high profits. Nature of fab structure and scale can help. Overhead structure (middle management bloat) is a negative influence
- However, the merged company is much weaker in large panels and weak overall in OLED (despite JDI's announcement that they plan to be in market by 2017 for small panel OLED and Sharp's OLED R&D)
- Sharp has typically had a very secretive culture: one wonders how well the merger would go through despite two Japanese organisations
- A number of commentators have already been suggesting that Sharp should just be allowed to fail and that the bail out by INCJ is not a good message about allocation of credit in Japan



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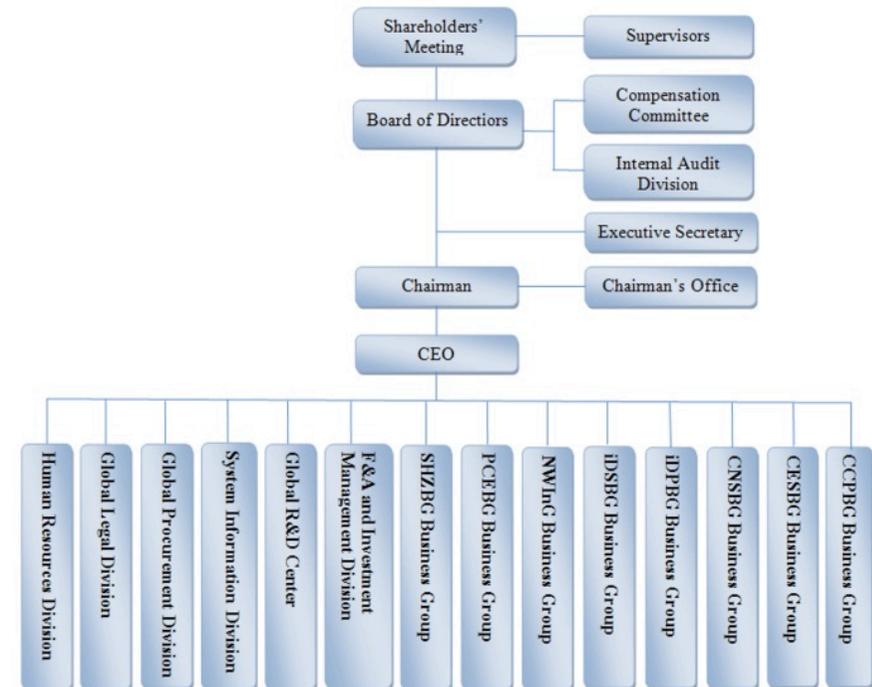
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Foxconn profile

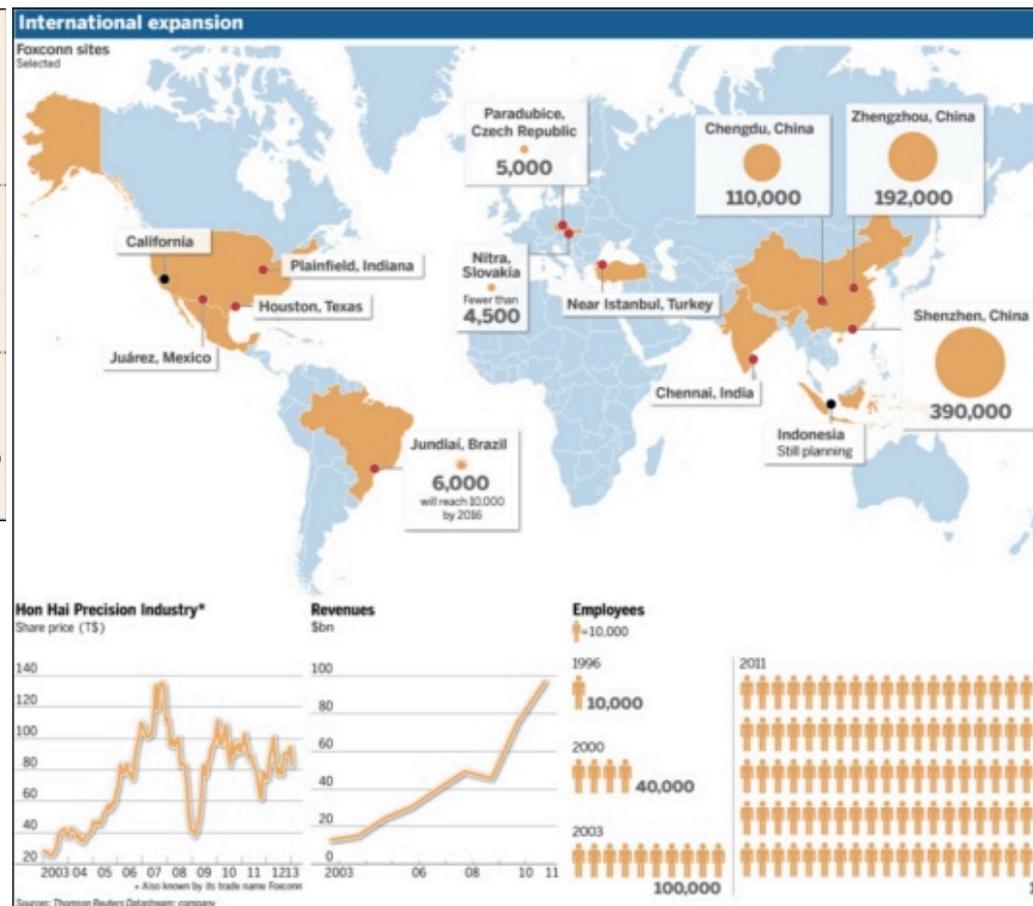
- Foxconn (Hon Hai) is the company built up by Terry Guo since it was founded in 1974 with revenues of over \$130bn by 2014
- Focused on 8 different business areas covering precision molds and machinery processing, internet networking, electronic components, consumer electronics, PC systems, servers, networking, and equipment integration
- Thin margins of only around 3% but massive scale and covering around 40% of all electronics sold globally
- Has received mixed press for its work practices of long hours in large factories but now is embarking on a programme of automation
- Has a list of clients representing a complete “who’s who” of the electronics world including Apple

Foxconn profile

- Revenues: \$132bn in 2014
- Profits: \$4.5bn in 2014 (3%)
- Employees: 1.3m with more than 400,000 in two different towns in China



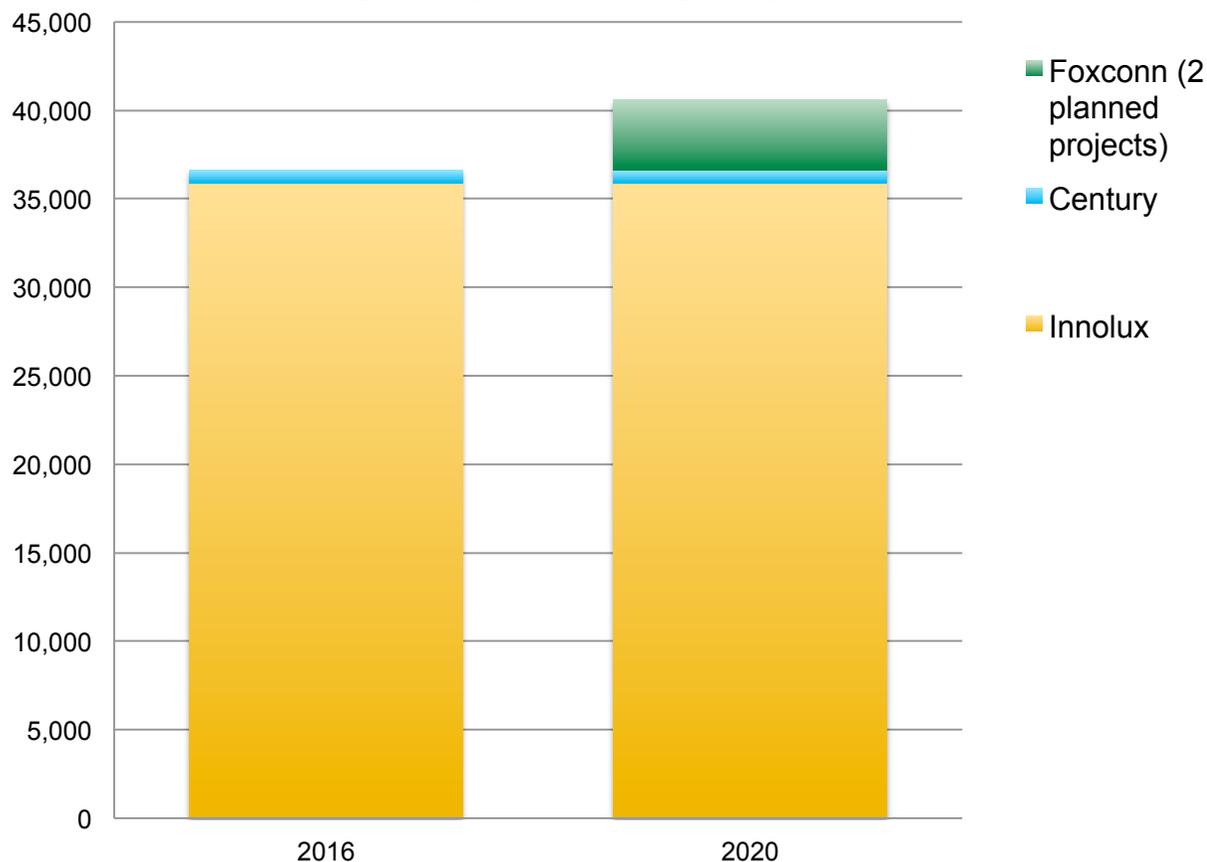
Foxconn is one of the main integrators for Apple and does a pretty good job at keeping Chinese walls between customer teams. Massive foot print across China



- A large diversity of sites in China including major locations in Chengdu, Zhengzhou and Shenzhen for Apple
- Our understanding is that Foxconn has done a fairly decent job at directing a diverse set of electronics competences at its different and competing OEM companies

Foxconn currently has access to a fair amount of capacity but the weakness in technology for the high end and ability to ramp all this new capacity:

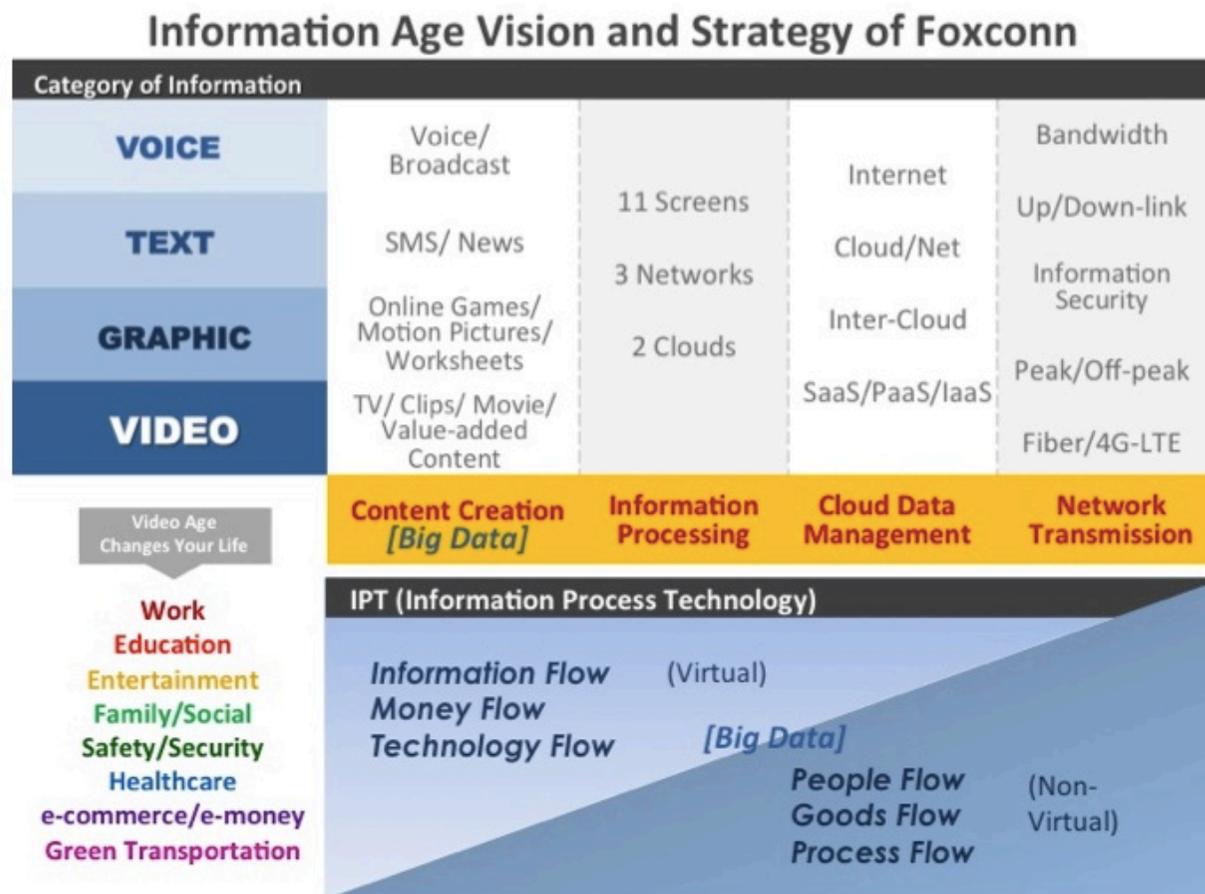
Capacity m2 000 per year



- By far the bulk of the current capacity that Foxconn has access to now is at Innolux
- Innolux is a solid second tier display player but has suffered a hollowing out of its small medium business and constrained on ability to expand further by capital markets in Taiwan. Innolux has technology but it is not in the top league
- Foxconn has in mind to ramp 2 new fabs in China (Zhenzhou and Guizhou)

Foxconn has an “11 screens” strategy from a display perspective:

- 11 screens strategy for displays: wearable, smartphone, tablet, notebook, desktop computing, portable TV, digital whiteboard, digital signage and then electric vehicle (automotive) and robot
- Overall Terry Guo has made automation and robotics a key part of his strategy despite the availability of a very large workforce
- Clear of the role of Big Data and the Cloud in the total picture: Foxconn is trying to diversify away from its EMS hardware based heritage
- Some e-commerce, SaaS and green related themes also



Foxconn's interest in Sharp has been technology/IP and innovation talent plus bench-strength in LCD execution in general:

- Foxconn started life as an EMS integrator which really includes only the skills to be able to execute on a design supplied by an ODM or OEM
 - While EMS margins are fairly slim, typically these customers are able to manage the fees they receive from OEMs for many services and they are not as asset intense as display or IC making for example
- Foxconn however has wanted to increase the internal share of wallet that it captures and the value added
 - This means deepening its technology depth in displays/touch, and perhaps later ICs and or other componentry
- Foxconn more than everything else wants to retain its premium client base also (including Apple) so access to the top end of display technology would differentially be important. Foxconn already has access to some technology capability in Innolux, but Sharp's technology is a notch better. Sharp's challenge technically has often been that it has pursued unique approaches not adopted by other players ("I do it my way" mentality)
- Foxconn also has a broad expansion plan for their display businesses in mind, and here Sharp's general LCD talent could be valuable. Getting LCD experts with real depth of understanding of how to solve LCD problems distributed across the total system would be important longer term

Financial analysts have always argued that Foxconn needs to bring the display in house since it is such a large portion of a bill of materials:

Preliminary Teardown Bill of Materials and Manufacturing Cost Estimate for the Apple iPhone 5c
(Cost in US Dollars)

Components/Hardware Elements	Details	16Gbyte	32Gbyte
	Pricing without contract	\$549.00	\$649.00
Implied Margin		68%	72%
Total BOM Cost		\$166.45	\$175.85
Manufacturing Cost		\$7.00	\$7.00
BOM + Manufacturing		\$173.45	\$182.85
Major Cost Drivers			
Memory			
NAND Flash		\$9.40	\$18.80
DRAM	1GB LPDDR2	\$9.50	\$9.50
Display & Touch Screen	4" Retina Display w/ Touch	\$41.00	\$41.00
Processor	A6 Processor	\$13.00	\$13.00
Camera(s)	8MP + 1.2MP	\$11.00	\$11.00
Wireless Section - BB/RF/PA	Qualcomm MDM9615M+WTR1605L+Front End	\$32.00	\$32.00
User Interface & Sensors		\$8.00	\$8.00
WLAN / BT / FM / GPS	Murata Dual-Band Wireless-N Module	\$4.20	\$4.20
Power Management	Dialog + Qualcomm	\$6.90	\$6.90
Battery	3.8V~1510mAh	\$3.45	\$3.45
Mechanical / Electro-Mechanical		\$20.00	\$20.00
Box Contents		\$8.00	\$8.00

Source: IHS Inc. September 2013

- One of the arguments muted by financial analysts for the deal has been to bring in house one of the largest chunks of value in a handset: that is the display/touch panel
- The example shown here is the tear-down of the iPhone 5c by iSuppli/IHS where the display module is 25% of the total bill of materials and also a key element in the reason why consumers select specific models

Most pressingly, Apple is putting pressure on display suppliers to be OLED ready for iPhone by 2017/2018. This puts pressure on Sharp and Foxconn to be ready

Models for involvement in the industry

Purchaser of product

Strong hand: influence players directly



Partial direct involvement (R&D and process specification)

Vertical integration

Previous behaviours of Apple

- Apple used to play the strong hand in the display industry organising the proliferation of technology and adoption of new approaches
 - E.g. FFS technology for IPS
 - E.g. Development of Flex OLED on PI for Apple Watch
- Doing the purchasing for equipment for new factories for key suppliers

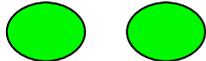
Recent moves of Apple

- However, the Apple has moved to opening a display centre based on the old Mirasol fab and has hired engineers
- There is also a major shift coming with the potential for Apple to move to AMOLED for iPhone from 2017. Sharp has much at stake in this shift
- So actively shaping the direction of the display industry at a detail level. Unlikely that Apple will want to go the full way to being a vertically integrated display provider, but will be interesting to see what economic structure evolves if Apple fundamentally specifies both product and process

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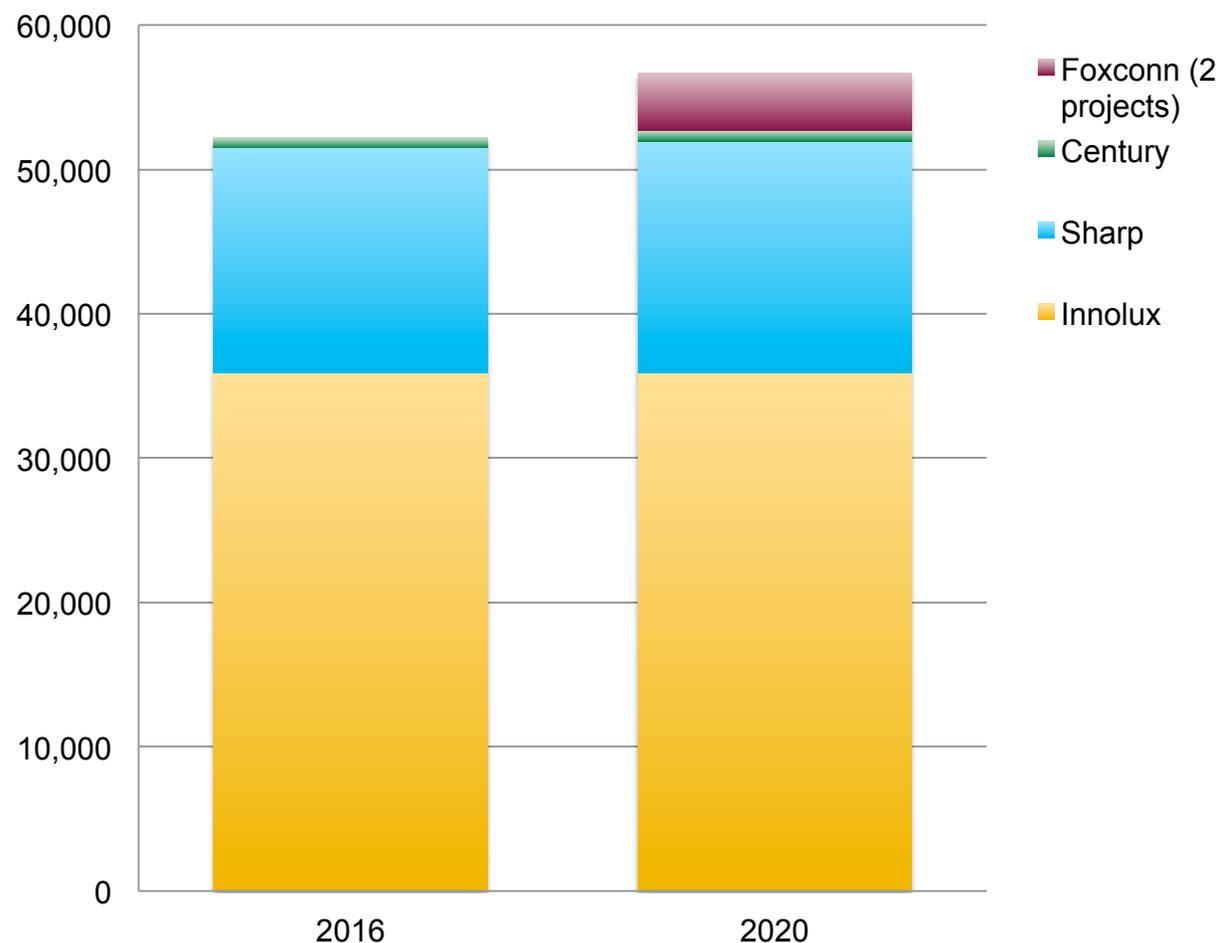
A combined Sharp-Foxconn-Innolux-Century combination has the following capacity and businesses:

	Small panel	Large panel	a-Si	LTPS CGS	Metal oxide	OLED	Quality of fabs	Quality of technology
Innolux								
Sharp								
Foxconn (Future)	Not in place	Not in place	-				To be built	Not clear
Century (1 Gen 5)								

- The total assets and technology now that Terry Guo can control is quite large
- Foxconn Guizhou and Zhengzhou fabs are both Gen 6 targeted on LTPS based OLED and it is not clear that without Sharp (or other serious technology provider) then Foxconn would easily be able to execute on something that complicated
- The Sharp technology piece (IGZO + LTPS + OLED + Deep LCD knowledge) it critical to making the total picture work
- Terry Guo has told Sharp that he will leave them as a standalone business at least initially, but we believe that the value from this deal only comes from dealing with the total system of fabs and competencies

A combined Sharp-Foxconn-Innolux-Century combination has all the following capacity and businesses:

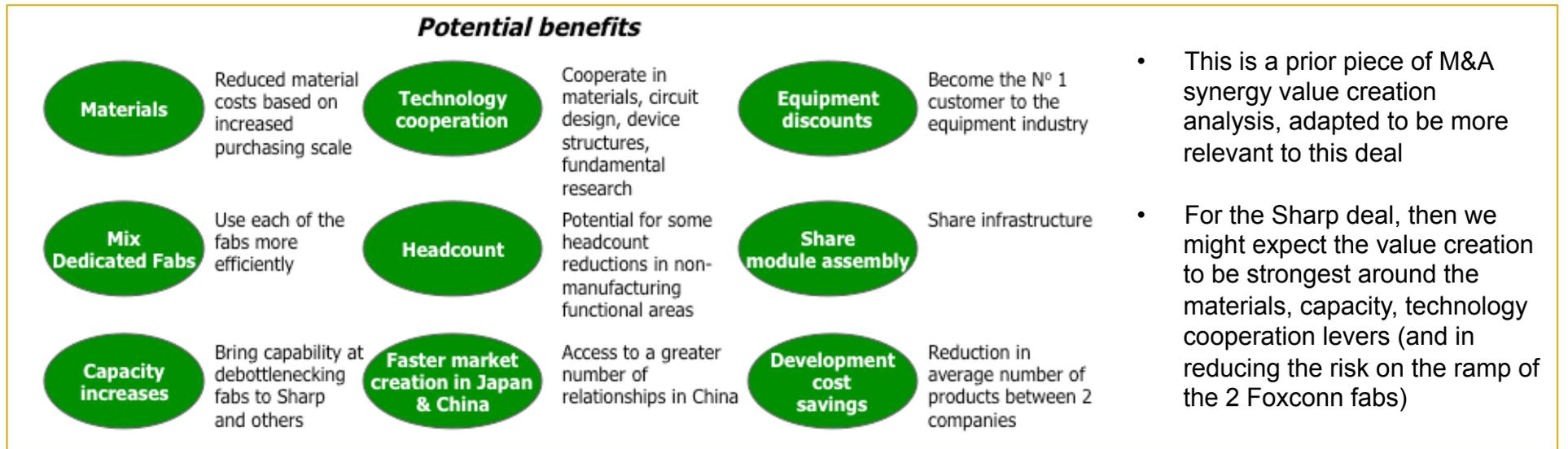
Capacity m2 000 per year



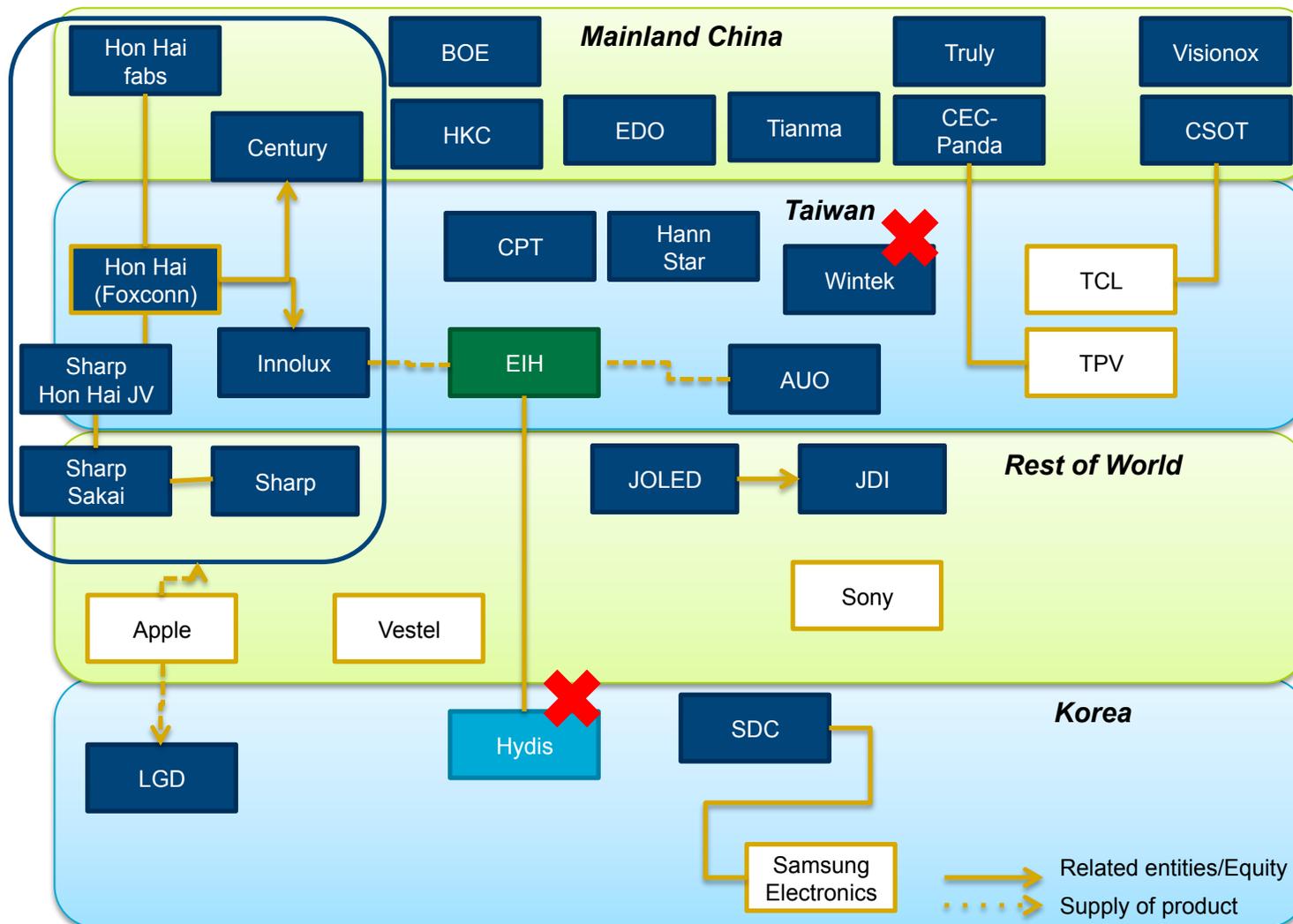
- As we can see, the Innolux fabs are by far the biggest piece of capacity in the total and Sharp brings a solid chunk
- The Century single Gen 5 is really not that important in the total (and perhaps one might consider moving the equipment elsewhere)
- The Foxconn planned fabs (here we assume are 60k/mo of Gen 6 LTPS based OLED each) are a significant technical challenge that would need the Sharp resources to be able to execute on (and even then additional expertise may be needed for OLED)

How M&A plans create value in the display industry

- We have been involved in quite a number of LCD M&A related transactions. Key economic drivers of synergy production include:
 - Materials synergy: Move the total to a simpler materials set and consolidate volumes/purchasing scale and use this to instigate a faster set of cost down roadmaps
 - Technology movements and collaborations: Here in particular, the OLED work, the flexibles work and the dissemination of LTPS and IGZO (High mobility backplanes) would be important in the total
 - Fab debottlenecking is a valuable and fairly immediate way of releasing extra value
 - One might imagine there could be some channel/client access upside elements by bringing Terry Guo's sales channels to Sharp
 - Of course there should be some implications from a headcount perspective (especially regarding Japanese middle management)
 - A larger total company should bring benefits in terms of the ability to purchase from the equipment industry
 - Being able to redistribute the total product mix across all the assets could bring additional small gains



The Foxconn cluster is a formidable total:



Industry stories in 2015-2016

- Sharp-Foxconn?
- Proliferation of OLED businesses in China
- Consolidation of capacity and power in the Terry Guo cluster
- LGD and SDC making ballsy investments
- Hannstar and CPT on the edge but CPT planning fab in China based on innovative technology
- Tianma with its emphasis on LTPS may be put under pressure too

From our point of view, the merger integration plan could be the following:

1

Develop OLED (Sharp + Innolux) based on best possible technologies from LTPS and IGZO underpinnings

2

Build the leading small medium business to challenge LGD and SDC

3

Use Sharp competencies to optimise the total large panel business also and rebalance total set of lines

4

Ramp the new capabilities in China

5

Develop new customer aligned roadmaps for new innovation platforms including Flexibles

- Sharp have already issued their public plan for how they would deploy the proceeds from their purchase and top of the agenda is OLED implementation
 - Despite their previous “We do not believe in OLED” stance corporately, Sharp has always had research on OLED in their labs and in particular they discuss their own approach to FMM in their purchase plans
- We believe that by pulling together the joint competencies of Sharp and Innolux together in small panels then the total group can reassert its influence on industry technical spec development
- We also believe that the total group could be a technical innovator in flexibles, in free form displays, new LC modes and other innovations, to rival SDC and LGD
- Some greater alignment of roadmaps to premium customer product plans would add value to the total
- Of course in addition are the standard synergy levers of getting value from purchased materials and equipment, dedicated mix and overhead savings

Sharp has already said that it wants money to invest in OLED and fix its fabs

Sharp's agenda with the money from Foxconn

Mass production of OLED in time for Apple's shift into OLED in 2018

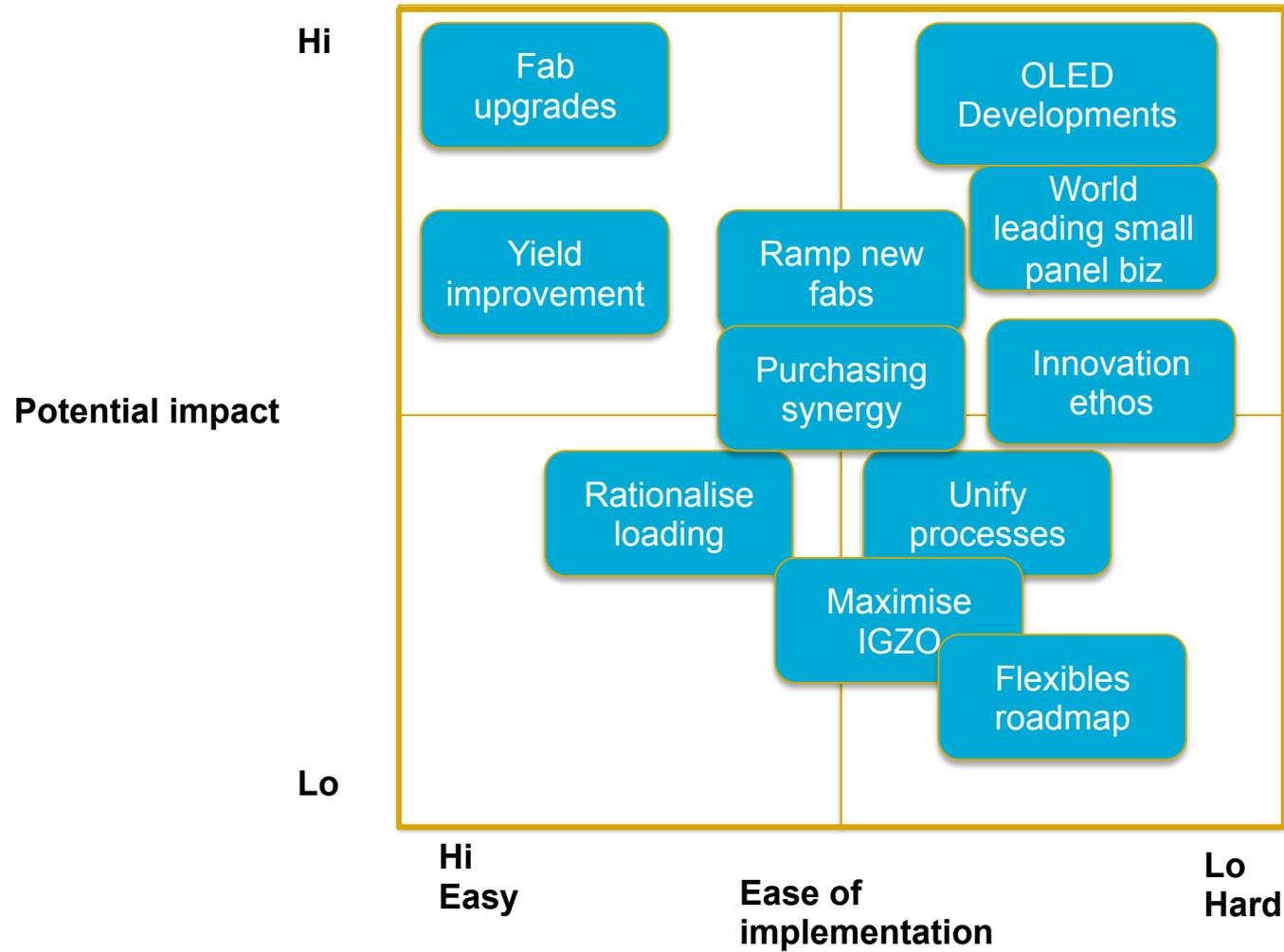
Development of position in flex OLED including encapsulation and PI

Capex upgrades at Kameyama and Mie including for Free form displays

Yield improvement

- Sharp has already laid out its agenda for what it wants to do with the cash from Foxconn
- The top agenda item is to be ready for Apple's push into OLED for iPhone by 2018
 - Sharp have had OLED in R&D for a long time despite a public face that said that LCD would win
 - Parts of the OLED agenda include working on Sharp's own FMM process, work on OLED encapsulation and PI spin/curing
- Sharp also plans to spend money debottlenecking and improving their fabs (which makes sense) and general yield improvement ideas

The merger integration plan: Impact of projects



Details of the merger integration elements (Top 12 project ideas)

	Idea	Impact	Complexity	Priority	Summary
1	Develop OLED	Mid-to-Hi	Hi	Hi	Retain Apple business and grow in OLED
2	Upgrade Japanese fabs	Hi	Low	Hi	Debottlenecking projects have very high returns typically
3	Yield improvements, Japan	Low-to-Mid	Low	Mid	Yield improvements; nice to have and worth the small capex number
4	Ramp Foxconn fab 1: Guizhou	Hi	Hi	Mid to hi but timing can be cycle adjusted	Requires a solid basis for OLED and LTPS first so can be pushed out
5	Ramp Foxconn Fab 2: Zhengzhou	Hi	Hi	Mid to hi but timing can be cycle adjusted	Requires a solid LTPS+ OLED or IGZO and OLED platform first
6	Develop leading small panel biz	Mid-to-hi	Hi	Hi	One of the priorities. Could be one of the areas that drives competitive advantage
7	Rationalise fab loadings	Mid	Low-to-Mid	Mid to Hi	Could be one of the relative quick wins of the total system but may require some process uniformity
8	Unify processes	Mid	Mid	Mid	Hard work and only likely to have longer term benefit

Details of the merger integration elements (Top 12 project ideas)

	Idea	Impact	Complexity	Priority	Summary
9	Maximise IGZO offering	Mid	Mid	Mid	Optimise technology value capture based on differentiated technology
10	Development of flexibles roadmap	Low-to-Mid immediate impact	Hi	Mid	Not much volume but high positioning impact
11	Spread innovation ethos	Mid-to-Hi	Hi	Mid	One of the key rationales of the deal long term
12	Purchasing synergy and scale	Mid	Mid to Hi	Mid to High	Use total scale to gain breakthroughs in purchased cost

- Clearly the total change programme might be much more sophisticated than this but we are trying to highlight some of the major programme ideas
- There would clearly need to be a complex HR and IT agenda plus a fair degree of commercial and business strategy reformulation to support the total
- The biggest challenge for Terry Guo will be working out how to time each of the change moves given a relatively small pool of deeply technical experts. Executing an improvement and growth agenda of this sophistication would require very careful coordination so as not to spread resources too thinly and to be able to manage ongoing business as well as the Project office programmes

Summary of the merger integration plan from a display perspective

- Foxconn needs Sharp for its technology and for its technical talent (at LCD) and R&D into OLED (to supplement the work that has already been done at Innolux)
 - Innolux has some basic bench-strength in LTPS and indeed in long term research into OLED but not the same level of pure innovation as Sharp. Indeed for “high-end technology” arguably Sharp is high up on the leaderboard with LGD and SDC
- In terms of technology, the Sharp work on OLED, on IGZO/LTPS (high mobility backplanes in general), on free form displays and its relative strength in small panels make it attractive
 - Innolux lost quite a bit of its small medium management strength to JDI/TDI
- One can argue that Sharp personnel also should be involved in ramping up the new Foxconn fabs in China (once the OLED technical approach is proven)
- Beyond the major themes of OLED and flexibles, factory upgrades and debottlenecking there are all the normal levers to be pursued as sources of synergy: scale in purchased materials, optimisation of assets (mix optimisation across production platforms and synergies in use of back end module assembly). One might also expect that Foxconn could optimise the value from the production base by trying to keep it fuller (higher capacity utilisation) than it might be on the open merchant market

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Summary and conclusions:

- Sharp for the early years produced fairly strong economic returns but the company over invested into Gen 10 too early, had a love-hate relationship with the merchant channel, didn't economically optimise their assets and were overly concerned with domestic Japanese business
 - Their efforts to try to sell differentiated product though have always set them apart as one of the best
- Foxconn has grown fantastically by harnessing the energies of complete Chinese towns, and of late, by deepening their technology capabilities
- Sharp for Foxconn represents a pool of technical experts and assets/business that can be further improved
 - M&A value is about bringing upside to a purchased asset and it is clear that Sharp has some upside by monetising their work on OLED, through debottlenecking their fabs and through pushing to the extreme their ideas for differentiated display product (e.g. freeform displays)
 - Sharp brings value to Foxconn by substantially reducing the management and technology risk involved in ramping up the 2 new Gen 6 projects that Terry has in mind
- Overall while there will be many managerial challenges, Sharp brings a fair amount of talent to the table if it can be appropriately harnessed. The devil will be in the detail in managing an immensely complex change agenda