
Display Economics in Europe

(A personal and provocative view on the strategic marketing plan for the European display business)

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Introduction to Hendy Consulting

Hendy Consulting: Value proposition and product offerings

Value proposition



Product offerings

Growth strategy	Partnering and M&A support	Investment support	Performance Improvement
<ul style="list-style-type: none"> Market entry strategies Strategies for organic growth or by partnerships/acquisitions Opportunity assessments Technology strategies 	<ul style="list-style-type: none"> Support for major commercial agreements, licensing, JDAs, JV and Acquisitions (Valuation, company structure, governance and negotiations) 	<ul style="list-style-type: none"> Commercial and technical due diligence Industry analysis to support investments Investment fund 	<ul style="list-style-type: none"> Cost levers Margin improvement Portfolio management Competitive performance and gap analysis



- Established in 2003
- Business model uses network of senior executives and strategists
- 20 professionals in most global locations
- Focused on displays, semiconductors and other high technology markets
- My own background: Initial training in strategy consulting. Display experience includes 8 years of display strategy with 5 years at Philips: in last role responsible for strategy for \$9bn of display businesses
 - CRT
 - LCD
 - PDP
 - OLED
 - New technologies



Ian Hendy – Display Experience is broad and deep

Portfolio	LCD	OLED	PDP/DLP/ LCoS	CRT	Emerging Technologies
<ul style="list-style-type: none"> Philips's Corporate Display Strategy (at all levels in the value chain) Philips Flat Display Systems strategy 	<ul style="list-style-type: none"> Established LG.Philips LCD Reported to chairman of board for LG.Philips LCD Capex decisions (P3, P4, P5, Kobe rededication) M&A strategy (small displays and large displays) Cost reduction/profit improvement Product strategy Marketing strategy 	<ul style="list-style-type: none"> Technology and partnering strategies Valuation Product strategy 	<ul style="list-style-type: none"> PDP termination decision (vs LCD and LCoS) Market strategy for LCoS Technology and commercial due diligence for LCoS 	<ul style="list-style-type: none"> Materials strategies Support at the board level of major CRT company on market strategy reflecting the role of LCD in the market Restructuring advice to the CRT industry 	<ul style="list-style-type: none"> New approaches to polarizers New approaches to flexible substrates

Introduction to Hendy Consulting: Typical assignments for clients from start-ups to multinationals

Established and aging technologies	Large panel displays	Small panel displays	New technologies	Drivers
<ul style="list-style-type: none">• Restructuring advice to the CRT industry	<ul style="list-style-type: none">• Previous work for leading large panel LCD company across many aspects while at Philips• Involvement in the formation of LG.Philips LCD	<ul style="list-style-type: none">• Partnering and M&A, growth and costing work for small panel display company• Providing input to a recently completed large merger	<ul style="list-style-type: none">• Work on new materials, new approaches and new technologies• For example, extended assignment into flexible displays for West coast start-up	<ul style="list-style-type: none">• Work with semiconductor companies on driver opportunities



The display industry is large and at a critical juncture...

\$70bn flat display industry is at critical juncture

- Large panel TFT market likely in systemic oversupply with new entrants from China still interested in joining industry
 - Fundamentally new approaches and new materials that deliver massive cost reductions are needed
- LCD TV market development heavily dependent on module-related material cost development and supply chain margins
- AMOLED business trying to break through
- Large number of start-ups trying to capture a slice of the action especially in previously monopolised markets
- A number of the larger players questioning whether they can make value through technology/IP in-licensing/out-licensing
- Many, many financial institutions trying to figure out where the best investment opportunities lie
- New opportunities on the horizon in flexible and plastic electronics

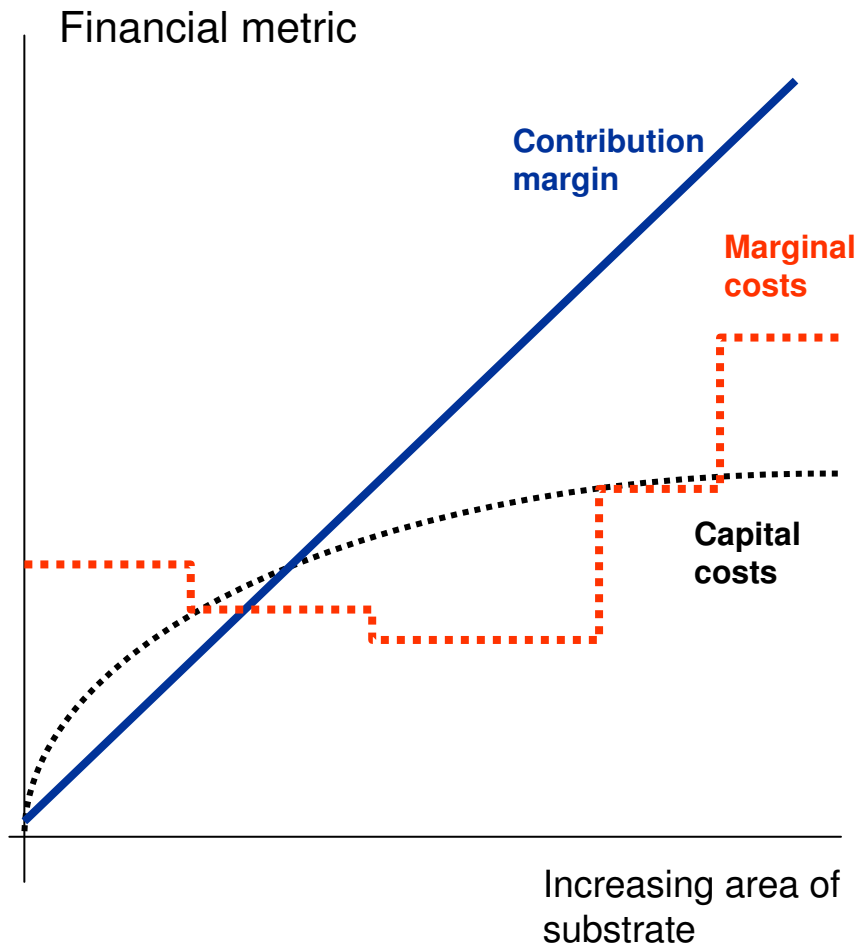
Implications

- New processes (including printing based) are now needed that are not in the current plans of the LCD majors (that will allow factory costs to be lowered substantially)
- The focus for companies now is on optical films, lamps and backlighting systems for LCD TV
- An AMOLED world would reshape the landscape and put more value into material companies hands. Materials companies already dominate in TFT-LCD
- Disruptive technologies need the resources and strategies to punch above their own weight to make this successful



...since sources of value from large factories are no longer a source of sustainable competitive advantage...

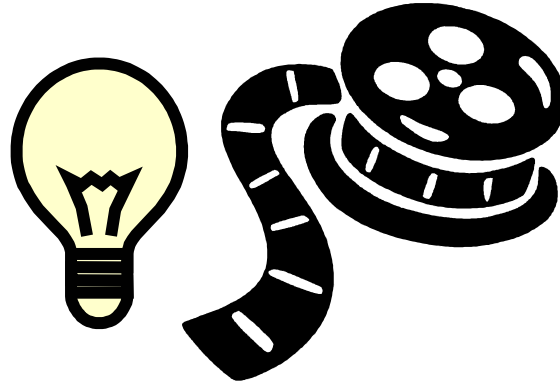
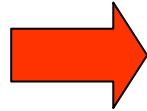
ILLUSTRATIVE



- Up to Gen 6, LCD factories of increasing generation increased the financial margin
 - Capital costs increase with the square root of the area
 - Margin increases broadly with area (margin arbitrage of panels of different sizes)
- However, including the costs of the industrial complexes that go with them, the new factories are not more effective than the earlier ones
- Moreover, the marginal costs for these factories are far worse

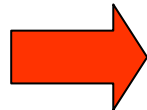


This changing industry landscape, means the *value* opportunities are not in the original places:

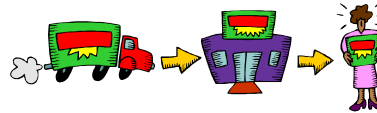


- Value is now less and less about deploying large scale factories and more about illumination and optics

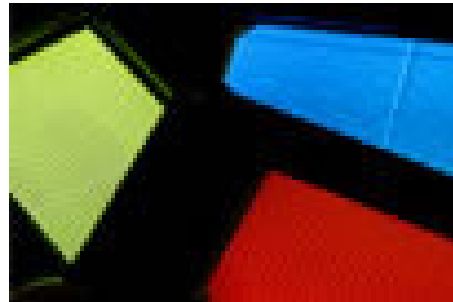
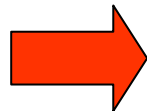
Capex/m²



NEW PROCESSES



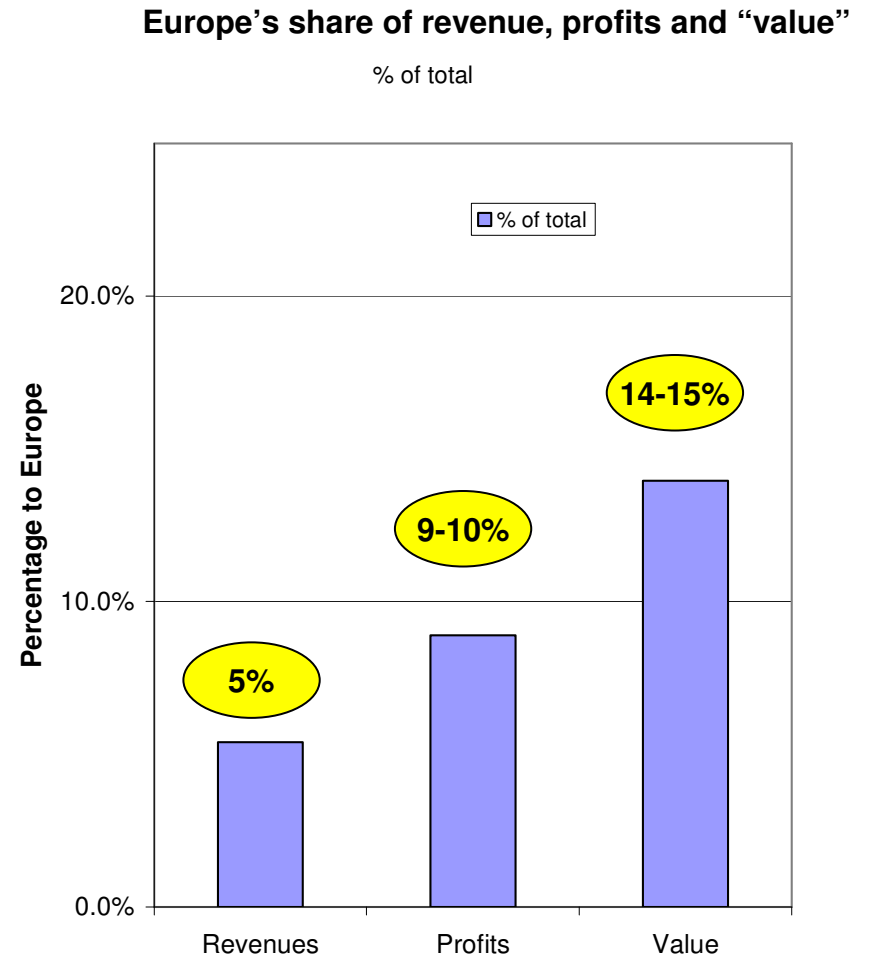
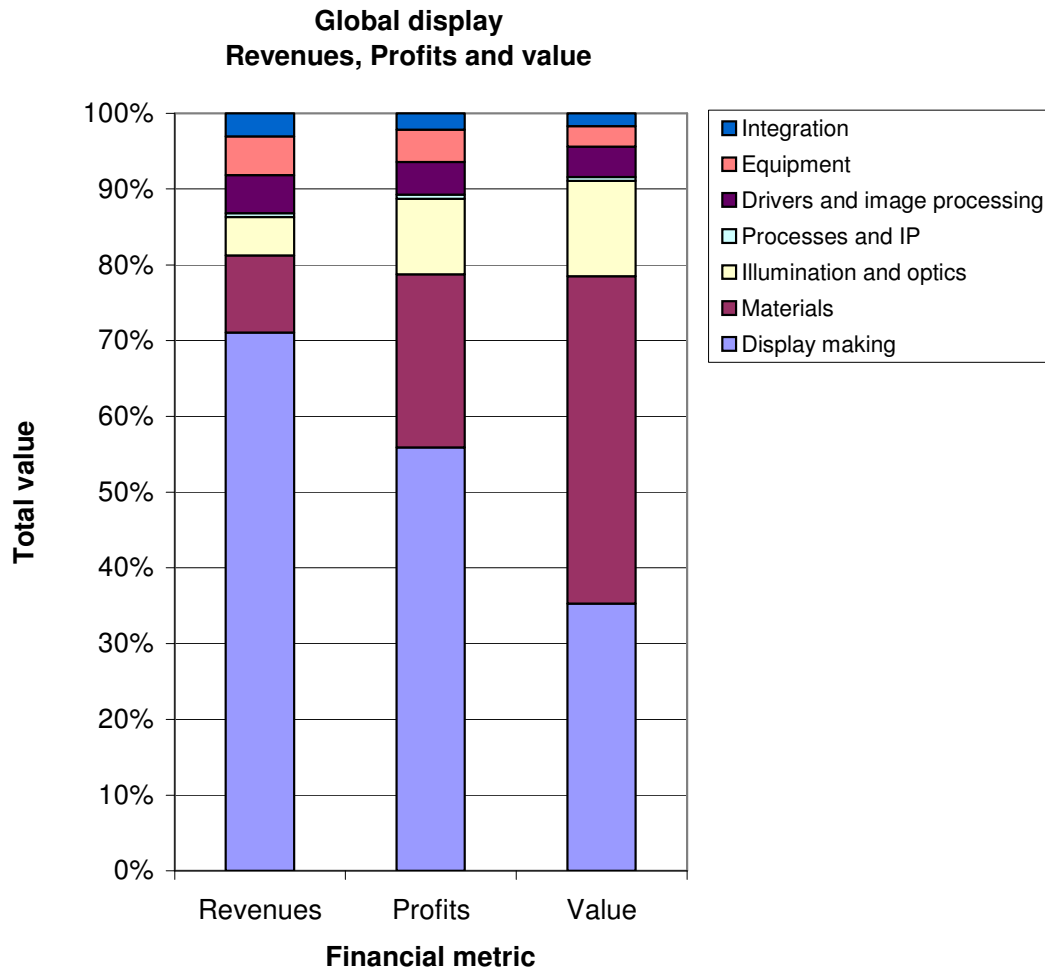
- It is no longer about capital, it's about new processes



- It's no longer about display making – its about materials, components and drivers



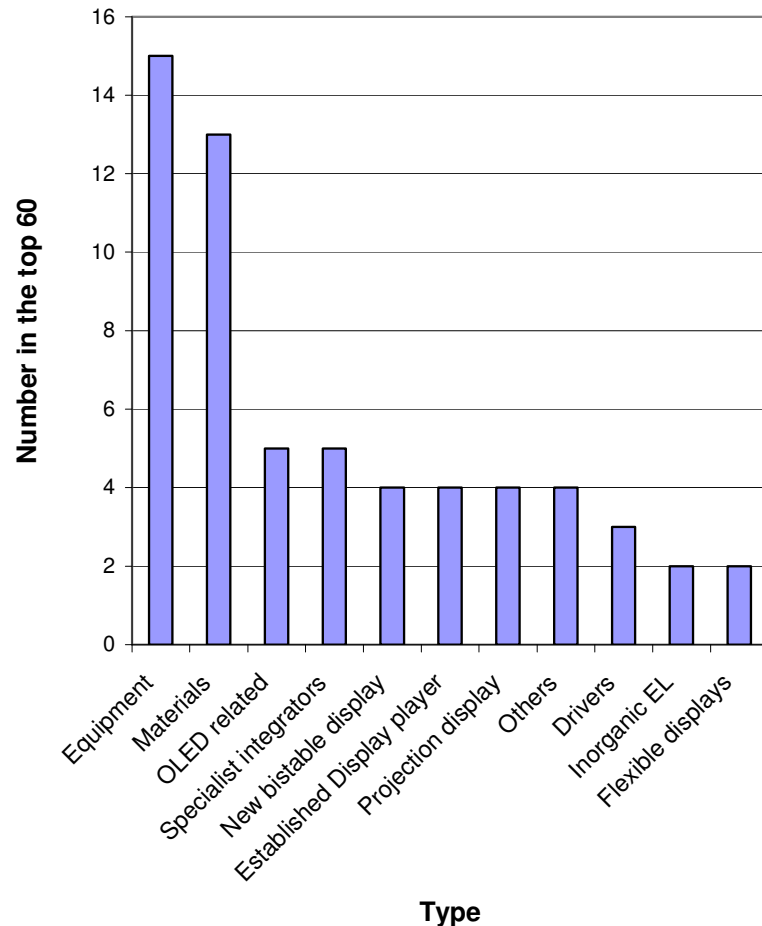
So while today's revenue is in Asia, Europe already gets it's a fairer share of value creation:



Source: Financial reports, HENDY Consulting estimates, HENDY Consulting analysis

Profile of today's European display businesses: On the whole we are sub-scale to the Asian competitors

Type of company - in the Europe top 60 companies



- Total of around \$8bn of display revenue
- 60+ different businesses
- 50+ start-ups
 - Most of them equipment or materials companies businesses
- Around 10 major businesses
- Average revenue of \$100-130m
- Average profit of around 6-8% of sales

BUT

- if we take out Merck and Philips (and the other large companies out of the mix) from the picture we see a different picture
 - Average revenues of \$40-50m
 - Average profits of around break-even

Source: Analyst reports, Company reports, text searches, Hendy Consulting analysis and many estimates

However, we do have some wonderful stories to tell...

Merck	Philips Lighting	CDT	Micronas	Barco	AIXTRON
<ul style="list-style-type: none"> • One of the true leaders in the display industry with a sizeable \$750m-\$1bn business at high margins • Has made recent forays into OLED materials (as a potential disruptive technology to LCD) • Clearly a true display global leader 	<ul style="list-style-type: none"> • UHP offering is a strong and highly profitable market offering • Philips lighting is now moving more solidly into the LCD backlighting market with its hot fluorescent lamp offering and link to LumiLEDs offering 	<ul style="list-style-type: none"> • Clearly, one of the leaders of the British display industry with a strong position in OLED materials and IP and a fascinating story of how it got to where it is today <ul style="list-style-type: none"> • Forays into the equipment also (Litrex) • Successful listing on NASDAQ 	<ul style="list-style-type: none"> • A fabless IC company selling 1-chip video signal processing solutions to the CRT and flat TV markets • Europe also has at least 2 other IC players: Dialog and ST Micro 	<ul style="list-style-type: none"> • Barco has built a phenomenal professional display integration capability for medical, professional and other specialist markets 	<ul style="list-style-type: none"> • Highly profitable equipment player focused on MOCVD technology • Looking at the OLED market for future opportunities • A flexible business model designed to withstand the cycles of the equipment industry
Materials	Illumination and optics	IP and materials	Drivers	Integration	Equipment



However, we do have some wonderful stories to tell (Continued):

DuPont Teijin	OTB	Plastic Logic	Elumin8	Micronic laser	SAES Getters
<ul style="list-style-type: none"> DuPont Teijin has the potential to be the Samsung Corning of the flexible display industry as well as its established position as a supplier to the optical films markets 	<ul style="list-style-type: none"> A potentially fascinating story where new in-line approaches to FPD manufacturing could change the economics of the FPD industry 	<ul style="list-style-type: none"> Clearly, one of the leaders of the British display and polymer electronics industry with quite some experience in new printing based techniques 	<ul style="list-style-type: none"> A fascinating inorganic EL business in the UK that pushes the boundaries of what people think that inorganic EL can achieve in quite imaginative ways 	<ul style="list-style-type: none"> A medium sized Swedish business that makes laser pattern generators for making photo-masks with an enviable client base, profit level and growth 	<ul style="list-style-type: none"> A specialist Italian materials business that supplies moisture getters to the CRT and flat panel industry with margins of up to 20% overall
Materials	New equipment approaches	New processes and IP	New display technologies	Equipment	Materials

So where does that leave us? Can we construct a strategic marketing plan for Europe?























A review of all of the market spaces in which Europe competes

(of which this slide represents a selection)

Display Economics in Europe

	Display making		Materials					
	Fabs and scale	High technology and new technology	LC	Glass	OLED	Plastics and films	Photoresist and chemicals	Others (Getters, sputter targets, gases)
Revenues (Estimated order of magnitude)	\$60bn	\$5bn	\$2bn ✓	\$3-5bn ✓	c. \$100m ✓	\$1-2bn ✓	\$3bn	\$1bn
Average operating margins (Representative numbers)	14% LCD Lower for PDP	Could be higher	40%	40%	40%	Estimated up to 20%	10-15%	up to 40%
Asset level	High	Mid-High	Mid	Mid	Mid	Mid-High	Mid	Mid-High
Risk	Mid	High	Low	Low	Mid	Mid	Low-mid	Low
Value creation	Mid	Mid	High	High	High	High	Mid-High	Mid-High
Example companies	LPL SEC AUO CMO	Sharp SEC	Merck	SS-Corning NEG Asahi	Sumitomo	DuPont Teijin Many others	Clariant	SAES Getters Mitsui Japan Air Gase
Example Europeans	None (LPL modules)	MED, ZBD, NTERA, Pelikon Elumin8 etc	Merck	Schott	CDT JV Merck	DuPont Teijin	Clariant	SAES Getters BOC
Role for Asia	Green	Green	Yellow	Green	Green	Green	Green	Green
Role for USA	Red	Yellow	Yellow	Yellow	Yellow	Green	Yellow	Yellow
Role for Europe today	Red	Yellow	Green	Red	Green	Green	Yellow	Yellow
Comments/Potential industry change	OTB in-line fabs could change economics of manufacturing	If Europeans can work in consortia and harness Eastern Europe for production	As Europe, we need to watch for competitive and disruptive threats	Can another European glass maker step into this business?	Value creation now only depends on adoption of AMOLED in volume	Here it is a battle between the global chemicals and plastics firms	This is primarily an Asian game with Clariant battling	Again this is mostly an Asian play, but Europe has some opportunities
Role for Europe tomorrow	Yellow	Yellow	Green	Green	Green	Green	Yellow	Yellow

....leads us to the fact that there are some solid opportunities for Europe....:

	Size and growth of profit/value opportunity	Current European competitive position	 Potential future competitive position	Key competitors	Key developments needed	Summary
Materials (LC, Glass, OLED materials Plastics, Photoresist, Chemicals, Gases)				Asia (Dominant)	Entry of mainstream European Chemicals companies	Top opportunity
Illumination and optics (Including optical films)				Asia (Dominant) USA (3M)	More competition with 3M. Philips to expand lighting franchise	Solid opportunity
Drivers and image processing				Asia (Dominant) USA (Getting stronger)	European IC cos seize the Drivers opportunities	Solid opportunity
Processes and IP				Asia (E.g. SEL) USA (E.g. Kodak)	Polymer electronics and new printing based approaches create value	Solid opportunity (but more limited scale)
Integration and specialist integration				Asia (mainstream integration svcs)	Europe expands its role in key segments	Solid "niche" opportunity
Display manufacturing				Asia (Dominant)	Cell+fill moves to Europe. Small in-line fabs play a role	New innovations might create new markets
Equipment				Asia (Dominant) USA (Also strong)	Small in-line fabs play a role. New processes	Speculative opportunity

Vision for the display industry in Europe 2015



Top opportunities

Materials

- The materials business is the single most important business opportunity for Europe from a value perspective

Solid opportunities

Drivers and image processing

- Image processing represents an important mixed signal opportunity for the semiconductor industry

Speculative opportunities

Specialist Integration

- Our European competence at professional, medical and industrial display integration is well positioned internationally

Illumination and optics

- Optics and illumination come a close second and combine understanding of lamps and optics with chemicals and plastics expertise

Processes and IP

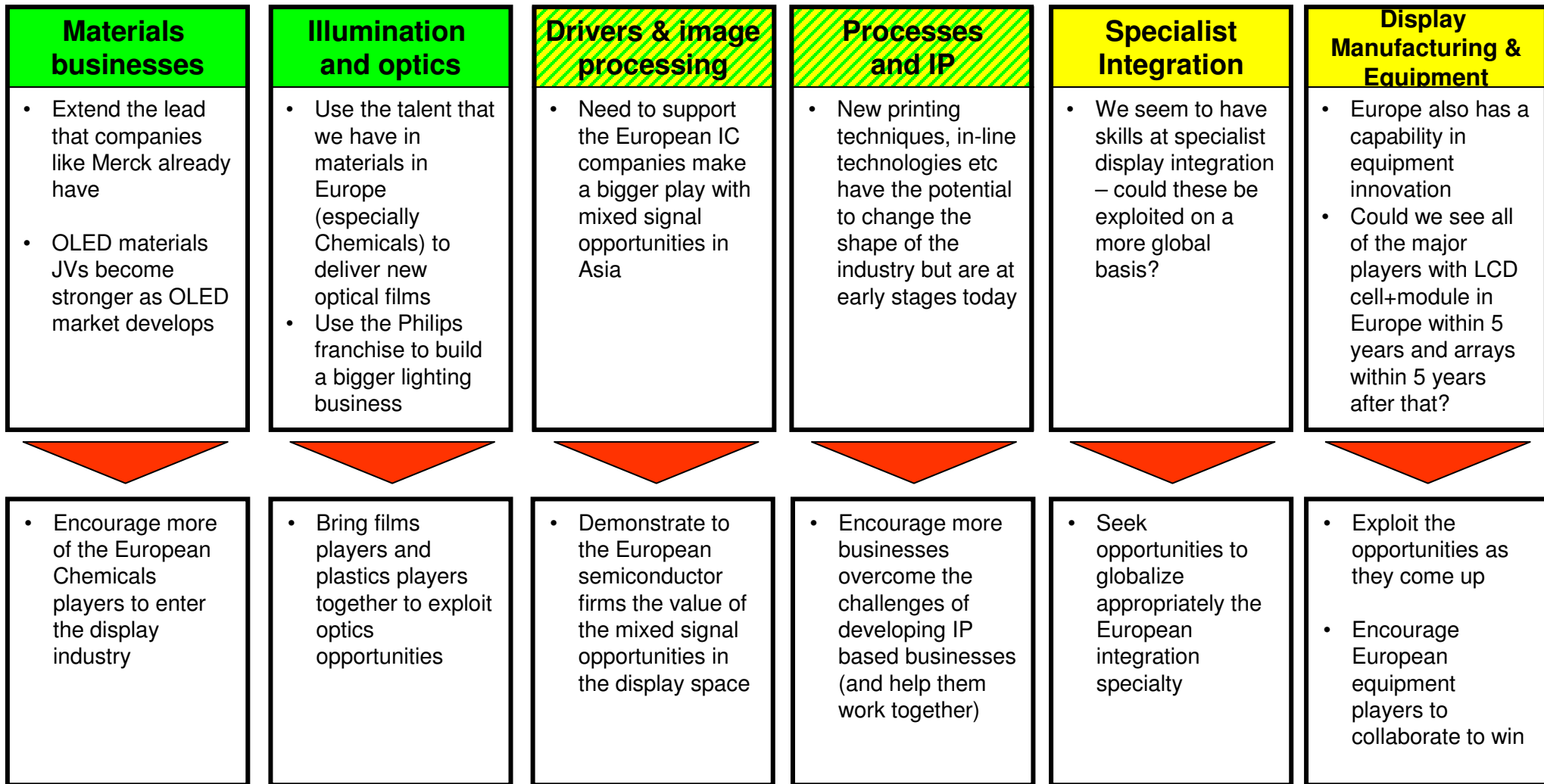
- While there is indeed opportunity in developing new processes (printing approaches, polymer electronics) the perennial problem is how to realize enough value from these

Display Manufacturing and equipment

- The opportunities in display making and equipment are speculative but could be very sizeable – new approaches give new opportunities



Vision for Europe 2015: What should Europe do to extend its areas of strength



Vision for Europe 2015: What we need to do to solve the business challenges for Europe?

	Partnering with Asia	Gaining funding and corporate development	Changing attitude to capital investment and manufacturing	Being competitive with Asia	Accumulating resources and HR perspective
	<ul style="list-style-type: none"> Challenge of building a business with Asian customers (language, cultural, differences in perceptions of time) What more can be done to help Europeans partner with Asia? 	<ul style="list-style-type: none"> European display businesses have harder time gaining VC or corporate funding 	<ul style="list-style-type: none"> Need to reduce the current cultural bias away from large capital investments – or find a way to make the investments in smaller chunks (as OTB proposes) 	<ul style="list-style-type: none"> Need to overcome labor cost (and other) differences with other sources of value and provide the right incentives Need to be able to exploit the talent in Eastern Europe for production 	<ul style="list-style-type: none"> Europe needs the fundamental engineering base to support a display industry with a much stronger orientation towards industrialisation (as well as our strength in R&D)
SID or trade org	Use SID level relationships to support building business relations?	SID to help build links between entrepreneurs and VCs or major firms (an introductions programme?)	Support display companies with the best information on what can be achieved in manufacturing	Stimulate discussion on how Europe can use its intellectual capital to its own advantage	Can SID do more (SID website does have careers section). Encourage universities to have display curricula
Governments	Increasing role to support on commercial issues as well as technical? Increase foreign office support? Fine tune tariff barriers?	A more commercial element to the services that the DTI provides?	Encourage capital risk taking and co-opetition between European players. Support science parks	Facilitate ventures with Eastern Europe. Perhaps some greater R&D and other tax credits to level the playing field.	-
Companies	Cultural training workshops? Longer time horizons? Hire Asian nationals?	Be prepared to work together more and to find investors with the necessary time outlook. Share stories	Consortium based investment behaviours?	Understanding of how to be competitive. Exploit Eastern Europe. Motivate work-force appropriately to increase competitiveness	Being prepared to look further a-field for the right talent

We need to support our businesses to develop the “6 elements of display industry value creation” through the right partnering, market and industrialisation strategies and by helping them “go the distance”

Partnering strategies can be important

Characteristics of profit leaders in the display industry

Some technology advantage

+

Oligopolistic/Monopolistic market

+

Supply constrained

+

Dominance of a market area

+

A full line of products to cover all opportunities

+

Investments to cover potential future substitutes

Full product approaches – breadth and depth means resources and commitment

Industrial strategies

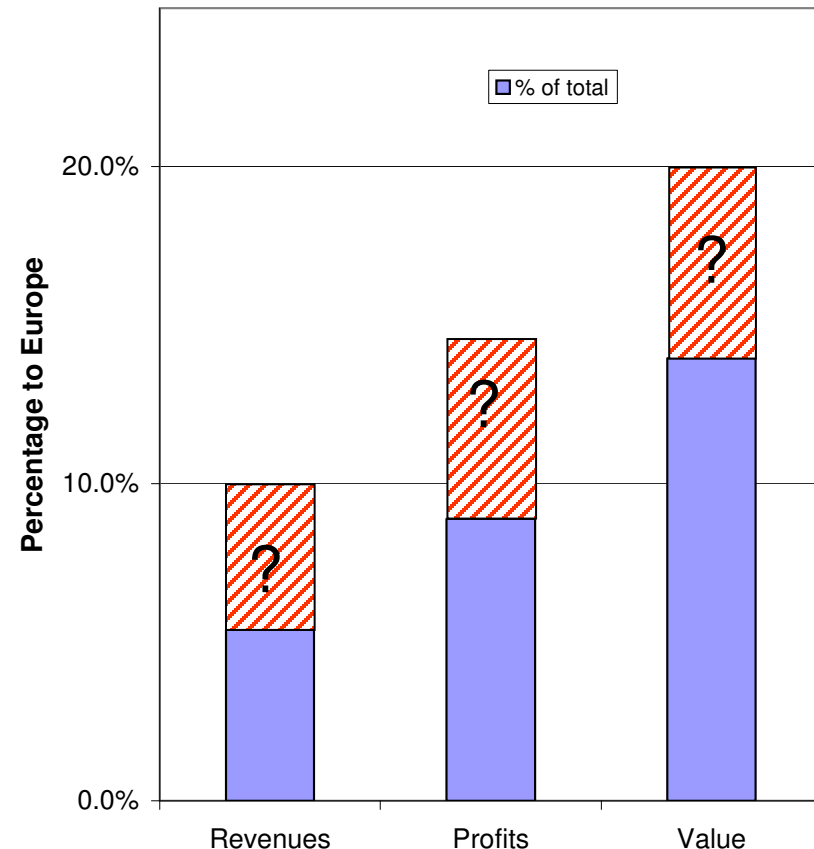
Market creation capability

Our vision: Europe could target 10% of global industry revenues, 15% of global industry profits but 20%+ of global industry value:

What if, all of the following happened:

- 3 new European chemicals businesses entered the market and built franchises similar to that of Merck
- 1 more European glass company decides to compete with Samsung Corning, NEG and Asahi
- All of the LCD majors put 1 LCD fab in Europe each by 2015 (and additional module and cell fill) while OTB-like equipment approaches start new “mini-mills” infrastructure and print based approaches gain currency
- OLED materials become big business
- One major European lighting company builds its position
- Polymer electronics and plastic substrates take 5% of industry volume
- Europe commercialises 1-2 fundamentally new display technologies
- Europe globalises its “professional integration” business

Europe's share of revenue, profits and “value”
% of total



Summary

- Far from being a non-player in the display industry, Europe does have a very valuable role that it can play in the following sectors
 - Top opportunities: Materials, illumination and optics,
 - Solid opportunities: Drivers and image processing, new processes, technologies and IP
 - Speculative opportunities: Specialist integration and new equipment approaches
 - Though its revenue contribution to the global display market is small, the value impact could be much more
- SID, the DTI and ADRIA should put together the structures that will allow the European display industry to flourish
 - Support partnering between European businesses, discussion of what it takes to succeed commercially as well as technically and the right pool of resources to be successful
- Hendy Consulting is a professional consulting services provider that works right across the global display industry and understands the challenges that we all face